2012 - JCR Evaluation Form

SPECIES: Elk
PERIOD: 6/1/2012 - 5/31/2013

HERD: EL740 - BLACK HILLS

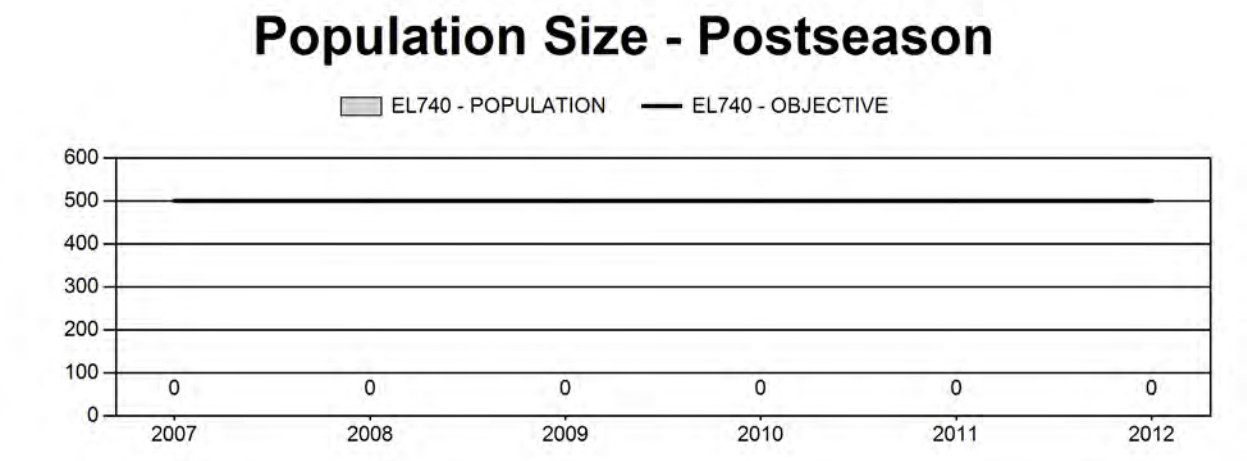
HUNT AREAS: 1, 116-117
PREPARED BY: JOE SANDRINI

	2007 - 2011 Average	2012	2013 Proposed
Population:	0	N/A	N/A
Harvest:	530	514	625
Hunters:	997	1,416	1,560
Hunter Success:	53%	36%	40 %
Active Licenses:	1,030	1,474	1,600
Active License Percent:	51%	35%	39 %
Recreation Days:	10,534	17,330	12,500
Days Per Animal:	19.9	33.7	20
Males per 100 Females	0	0	
Juveniles per 100 Females	0	0	

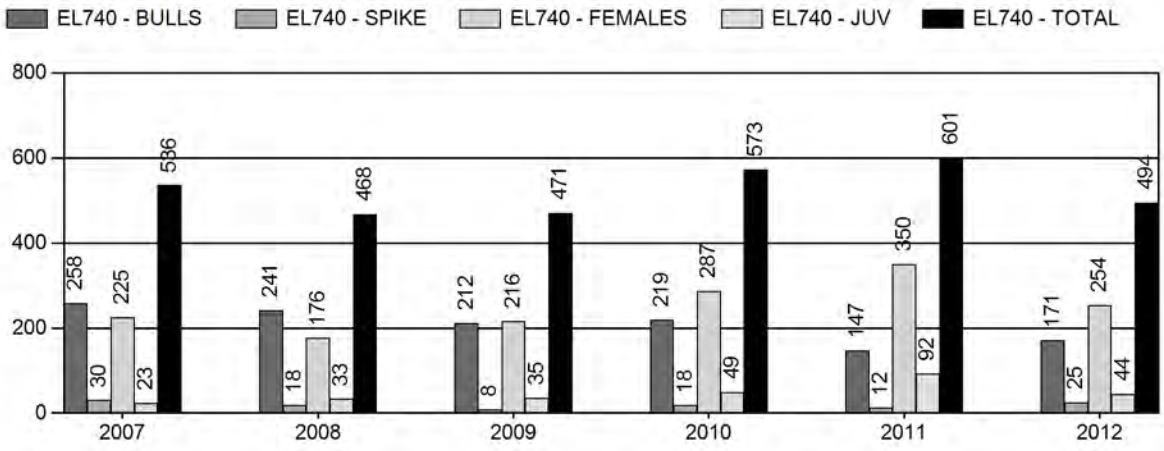
Population Objective:	500
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	N/A%
Number of years population has been + or - objective in recent trend:	0
Model Date:	None

Proposed harvest rates (percent of pre-season estimate for each sex/age group):

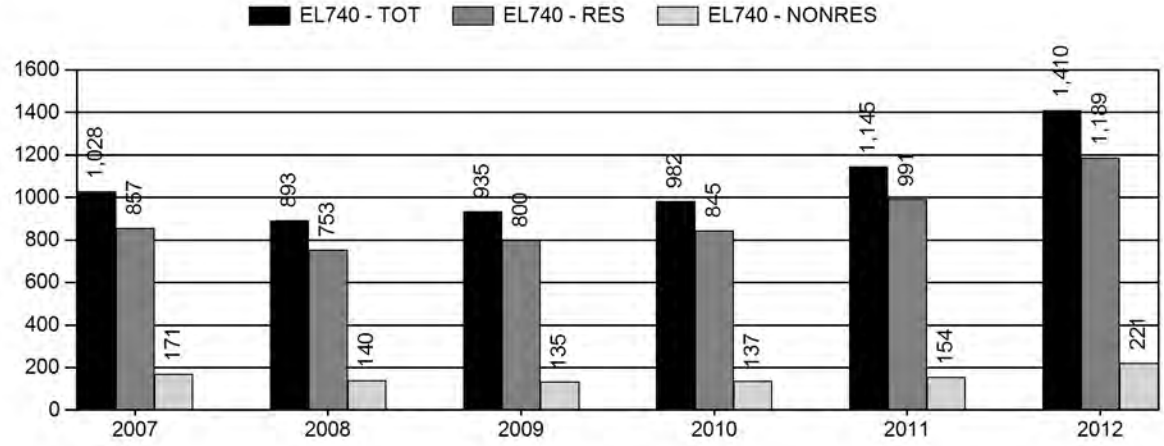
	JCR Year	Proposed
Females ≥ 1 year old:	n/a%	n/a%
Males ≥ 1 year old:	n/a%	n/a%
Juveniles (< 1 year old):	n/a%	n/a%
Total:	n/a%	n/a%
Proposed change in post-season population:	n/a%	n/a%



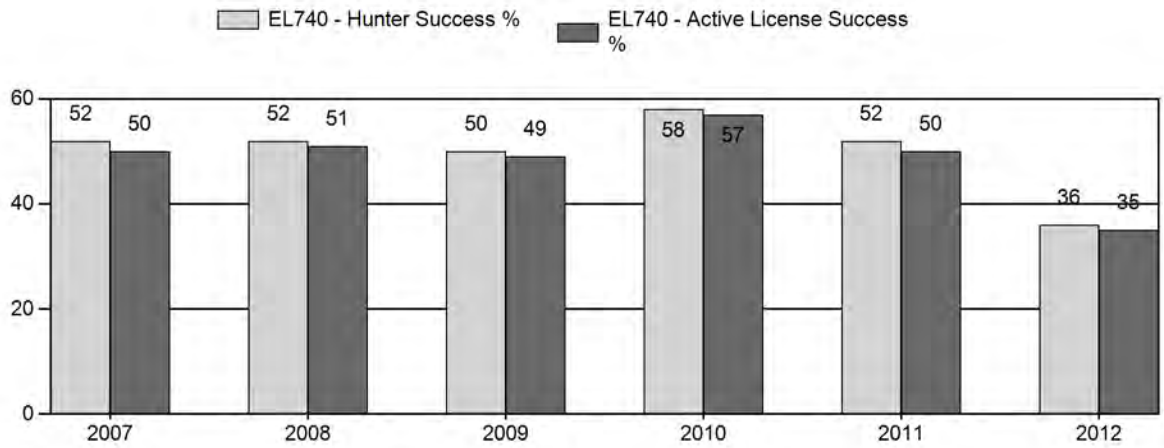
Harvest



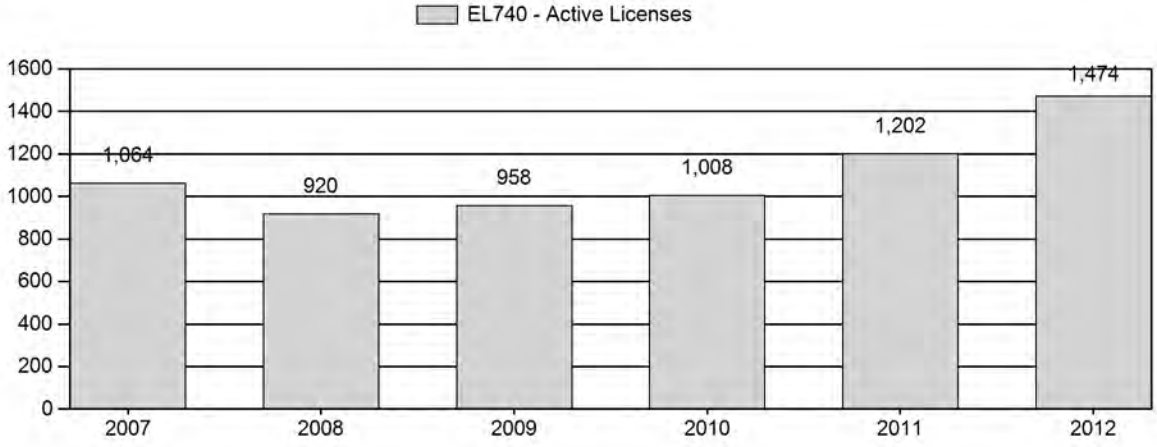
Number of Hunters



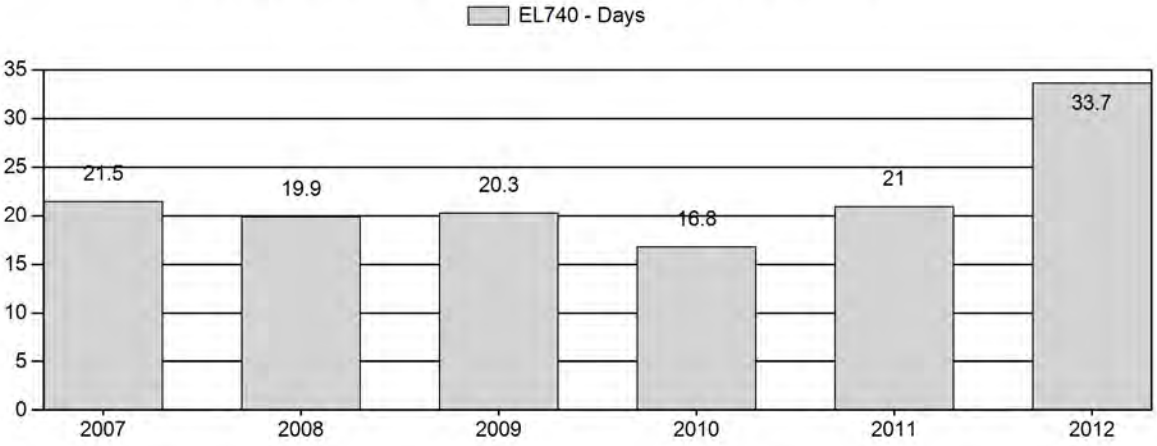
Harvest Success



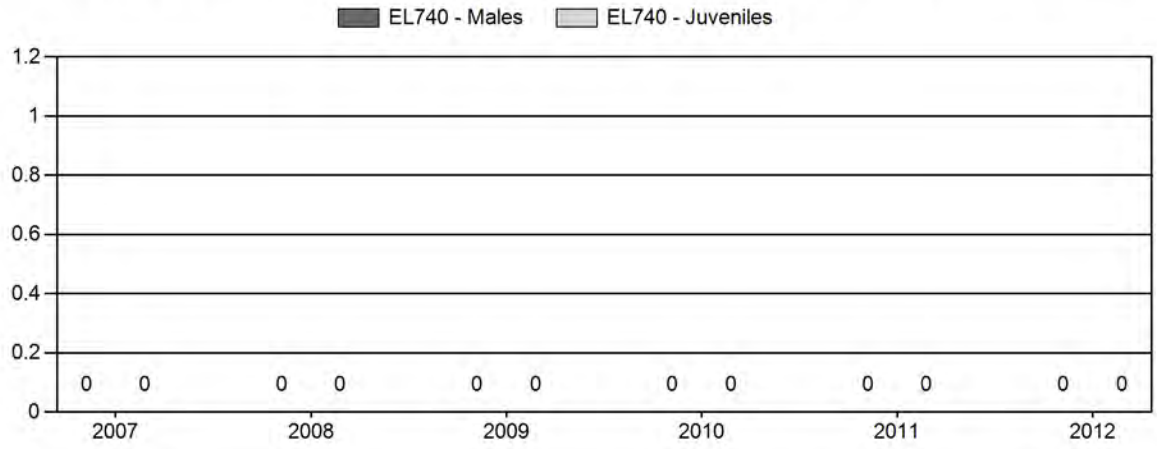
Active Licenses



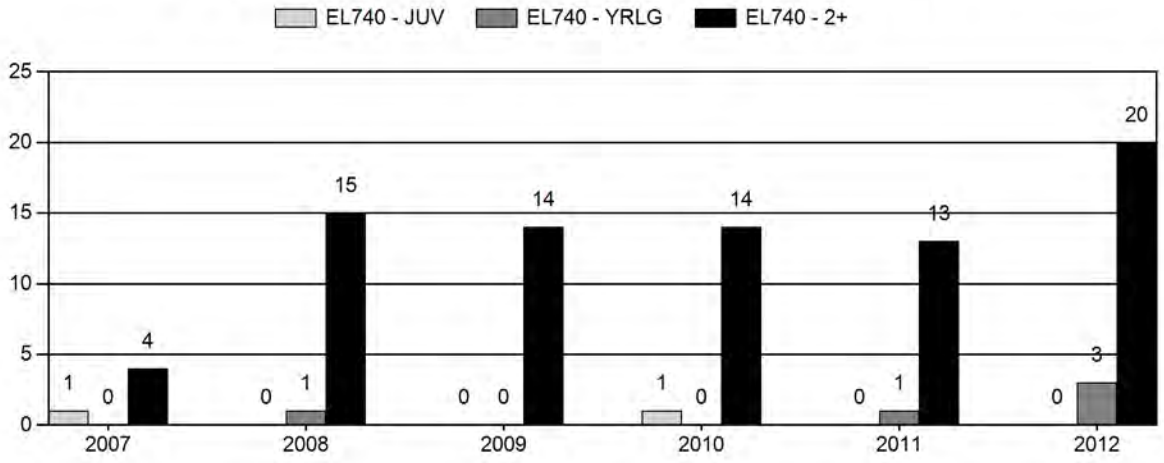
Days per Animal Harvested



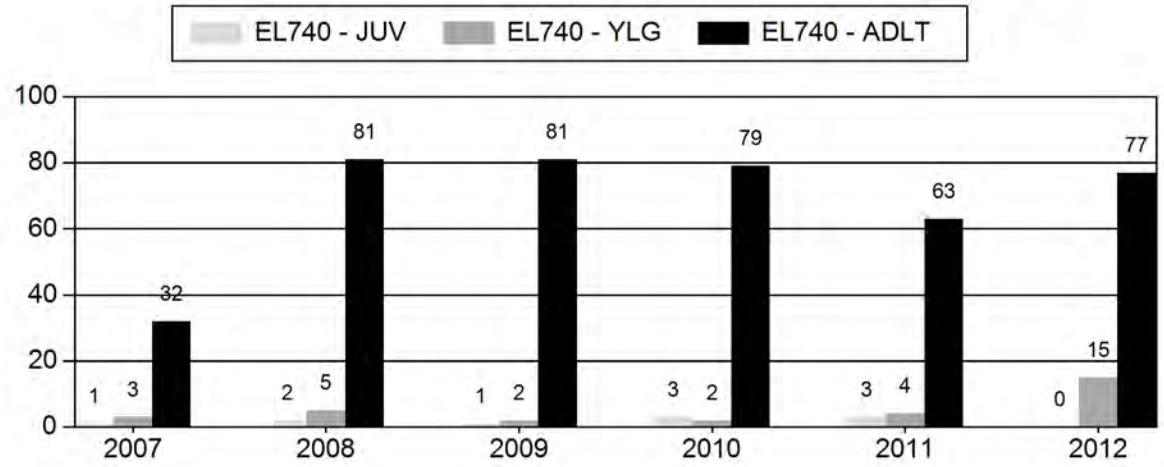
Postseason Animals per 100 Females



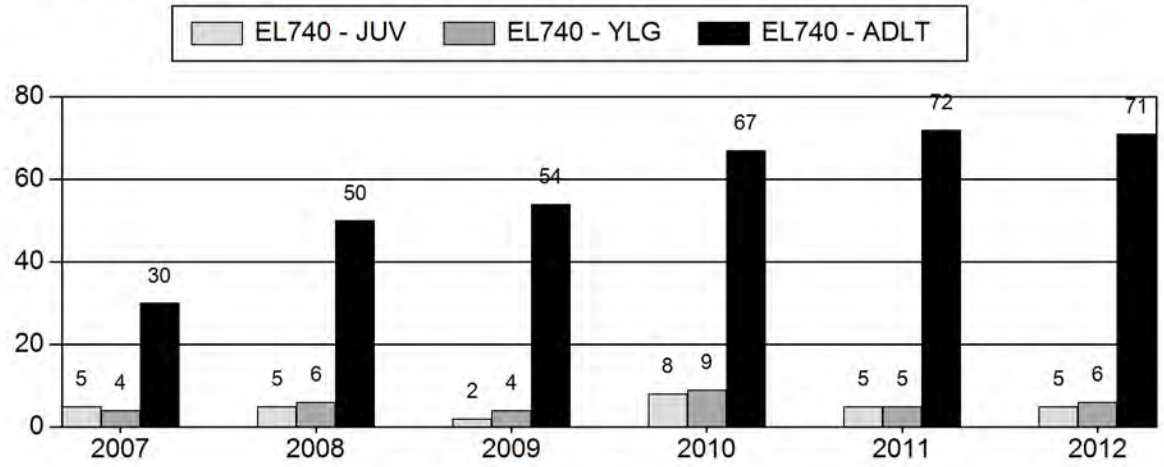
Age Structure of Field Checked Males



Age Structure Data (Field and Laboratory) - Male



Age Structure Data (Field and Laboratory) - Female



2013 HUNTING SEASONS
BLACK HILLS ELK HERD (EL740)

Hunt Area	Type	Season Dates Opens	Closes	Quota	Limitations
1	1	Oct. 15	Nov. 30	100	Limited quota licenses; any elk
	4	Oct. 15	Nov. 30	75	Limited quota licenses; antlerless elk
116		Oct. 15	Nov. 10		General license; any elk
		Nov. 11	Nov. 30		General license; antlerless elk
	6	Oct. 15	Jan. 31	250	Limited quota licenses; cow or calf
	8	Aug. 15	Oct. 14	50	Limited quota licenses; cow or calf valid off national forest
117	1	Oct. 15	Nov. 30	275	Limited quota licenses; any elk
		Dec. 1	Jan. 31		Unused Area 117 Type 1 licenses valid for antlerless elk
	4	Oct. 15	Jan. 31	250	Limited quota licenses; antlerless elk
	6	Oct. 15	Jan. 31	250	Limited quota licenses; cow or calf
	8	Aug. 15	Oct. 14	50	Limited quota licenses; cow or calf valid off national forest
Archery		Sept. 1	Sept. 30		Refer to license type and limitations in Section 3

Hunt area	Type	Change from 2012
1	1	-50
	4	-25
116	1	-200 *
	4	-100 *
	6	+100
	8	+50
117	1	-75
	4	-50
	6	-125
Herd Unit Total	**1**	**-325**
	4	**-175**
	6	**-25**
	8	**+50**

** Replaced with General License*

Management Evaluation
Current Management Objective: 500
Management Strategy: Recreational
2012 Postseason Population Estimate: None *(Field Estimate ~ 3,000)*
2013 Proposed Postseason Population Estimate: None *(Field Estimate ~ 3,000)*

HERD UNIT ISSUES: The management objective for the Black Hills Elk Herd Unit is a post-season population estimate of 500 elk, and the management strategy is recreational management. The objective was set in 1993 and is currently being revised towards a set of Administration-approved, non-numerical objectives, under the private land management strategy.

We can neither construct a population model, nor generate a population estimate for this herd as the Department has never been able to collect meaningful classification data. Additionally, radio collar data show substantial numbers of elk regularly cross the Wyoming/South Dakota Stateline violating the closed population assumption of population models. Consequently, no attempts have been made to model this population since 1996. Instead, this herd has been managed in an ad hoc fashion to provide ample recreational opportunity and address depredation complaints. In many locations across the herd unit, management of elk numbers has been hampered due to constrained access to private land for elk hunting. Consequently, a large part of this herd unit was placed into general license elk Hunt Area (HA) 129 in 2008.

The Black Hills Elk Herd Unit is currently comprised of HA 1, 116, & 117, as redefined in 2013. It is located in the northeast corner of Wyoming, and encompasses approximately 3,100 mi^2, of which about 1,650 mi^2 are considered occupied habitat. The majority of the occupied habitat is private land. HA 1 is 95% public land, and represents the largest contiguous block of public land extensively inhabited by elk. Elk do occur on other portions of the Black Hills National Forest

and dispersed sections of State and other federally owned lands. However, harvest and elk use in those areas is neither ubiquitous, nor consistent.

The herd unit boundary has been revised several times over the past 30 years, as elk hunt area boundaries were altered. The herd's seasonal range map was last updated in 2003 using field observations and contacts with landowners to make delineations. Changes to crucial winter range were not made at the time due to the lack of protracted, severe winter weather. Also in 2003, a small portion of the Black Hills formerly outside the Herd Unit (Elk Mountain) was included to better reflect elk distribution and habitat. In 2008, Elk Mountain was incorporated into HA 117, while the northwest third of this Hunt Area and a large portion of HA 116 were placed into HA 129. However, the herd unit boundary and seasonal range map were not adjusted to reflect these changes. With the redefinition of HA 116 for the 2013 hunting season, the three Elk Hunt Areas comprising this herd unit now encapsulate Wyoming's Black Hills ecosystem, and future changes in Hunt Area boundaries are not anticipated. After approval of the proposed objective change, Herd Unit boundary and seasonal range maps will be updated.

WEATHER: Drought conditions, which were persistent throughout the Black Hills between 2000 and 2007, began to moderate in 2008. Between 2008 and 2012, annual temperatures were below the previous 30-year average and annual precipitation each year above the previous 30-year average; and 2010 was significantly colder and wetter than both the 30-year and 100-year averages (http://lwf.ncdc.noaa.gov/temp-and-precip/time-series). The predominant weather pattern was characterized by generally cool summers, more persistent snow cover in late fall and winter, and above normal spring moisture. The combination of average winter weather and fair forage conditions seemed to have been neither detrimental, nor beneficial for Black Hills elk; but did result in localized depredation complaints in late December and early January each year. These were more pronounced during the winter of 2010-11, which saw periods of extended low temperatures and persistent, deep snow cover. Since the late 1890's, only five other winters were as cold and snowy as the 2010-11 winter. This tough winter preceded bio-year 2012, which was one of the driest on record. Warm and dry conditions beset the area in April of 2012, and continued through the 2012-13 winter. April of 2013 finally saw a break in this pattern when temperatures dropped below normal for the entire month and significant precipitation was again received (http://www.ncdc.noaa.gov/temp-and-precip/). Overall, the weather pattern during bio-year 2012 resulted in poor forage production and led to several large wildfires in the southern half of the herd unit.

Based on weather and habitat conditions over the past five years, it is likely elk have entered the winter in fair condition most years. More normal winter temperatures and precipitation did increase winter stress on elk compared to the previous decade, as did the drought of 2012, and winter forage availability appeared to decline during the reporting period. In summary, weather the past several years, while not favorable for elk, has not been overly detrimental.

HABITAT: The Black Hills is the western most extension of many eastern plant species. These species are often mixed with more typical western plants providing a large variety of habitats used by elk. Ponderosa pine (*Pinus ponderosa*) is the predominant overstory species. There are scattered patches of quaking aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), bur oak (*Quercus macrocarpa*), and in the southern hills mountain mahogany (*Cercocarpus*

montanus). Many of these stands are in late successional stages. Important shrubs include Saskatoon serviceberry (*Amelanchier alnifolia*), Oregon grape (*Berberis repens*), common chokecherry (*Prunus virginiana*), and wild spiraea (*Spiraea betulifolia*). Since 2000, wildfires in both Wyoming and South Dakota have burned well over 10% of the Black Hills National Forest (BHNF) and significant areas of private land in this ecosystem. These fires have been beneficial for elk by creating early successional plant communities and increasing available forage.

Elk habitat quantity and quality are good, but security areas may be decreased or lacking in areas due to high road densities. Road densities, along with vast tracts of commercially thinned ponderosa pine stands, do not provide what is usually considered classic, good elk habitat. Despite the lack of cover in areas and numerous roads, the elk population expanded through most of the previous decade. Several factors have benefited this population. First, herbaceous forage is abundant, and wildfires have increased elk forage. Second, despite high road densities, much of the land inhabited by elk is privately owned. This private land experiences limited human activity, so roads there may not significantly impact elk. Many of these same private land areas provide elk refuge from hunting pressure during the fall. The USFS has also increased the number of road closures on the Black Hills National Forest in the past 10-years, and recently adopted a revised travel management plan, although enforcement of closures is lax.

Currently, there are no habitat evaluation or vegetation surveys located within this Herd Unit related directly to elk forage or cover. A single mountain mahogany, and two bur oak, production and utilization transects were established within the Herd Unit in 2003 to quantify habitat conditions related to deer management.

FIELD DATA: Collection of classification data was suspended in this herd in 1996. However, tooth age data have been collected from harvested elk since 1987.[1] Tooth age data can estimate annual recruitment by considering the percentage of yearlings in the female segment of the harvest (Figure 1). Since 1987, this figure has averaged[2] 17% (std. dev. 8.1%), suggesting just under 20 yearling bulls and 20 yearling cows are normally added per 100 adult cows into this population annually. However, recruitment of yearling elk has declined since 2000. Between 1987 and 1999, as this herd grew rapidly, older age classes of female elk were well distributed throughout the harvest and there was an increasing percentage of yearling cows represented in the harvest; but, this trend reversed itself beginning in 2000 (Figure 1). A Student's T-Test indicates yearling recruitment was significantly higher between 1987 and 1999 when there were an average of 20% yearlings in the female harvest, versus an average of 11% after 2000 ($p=0.0004$)[3]. Since 2000, with significantly increased license issuance and extended hunting seasons, there has been a general increase in the percentage of female elk over age 5 harvested (Figures 2). Of course there is greater hunter selectivity when it comes to take of bulls, and since 2006, tooth age data has revealed fairly consistent, relative percentages of middle aged males in the harvest (3-5 year old bulls), with a slight increase in the percentage of older bulls harvested (Figure 3).

[1] Budgetary constraints prevented tooth age data collection in 2002 & 2003.
[2] Omitting 1990 data reduces this average to 16% with a std. dev. 6.0%.
[3] Including 1990 data in T-test yields a significant difference (P= 0.0001), with Mean 1987-1990 = 22%; and Mean 2000-2012= 10.9%.

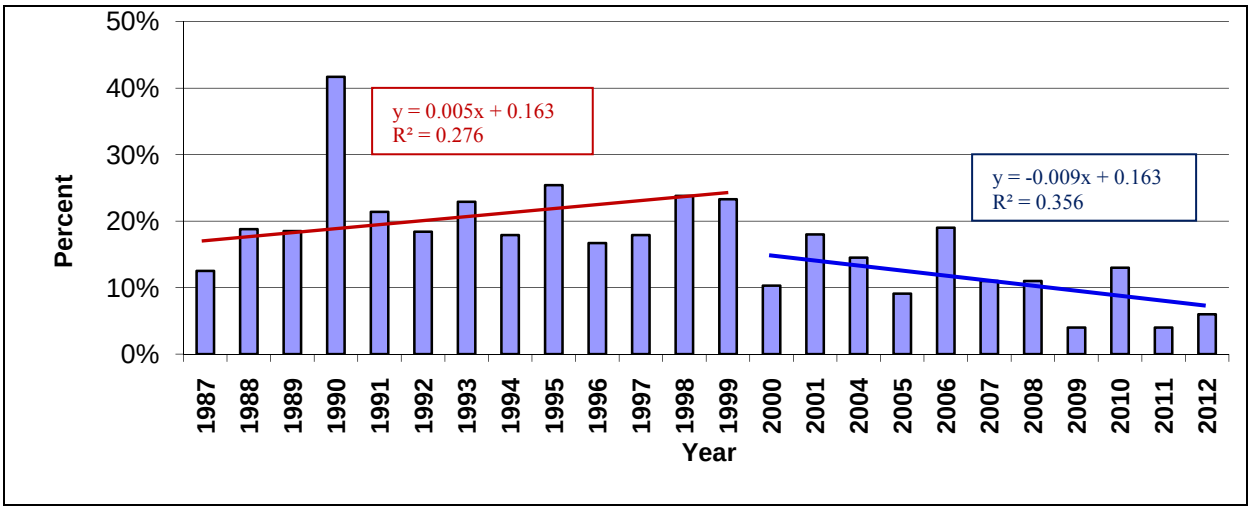


Figure 1. Percentage of yearlings in the female segment of the elk harvest (1987 – 2012).
(Note, trend lines exclude 1990 datum)

HARVEST: The low number of yearling females present in the harvest in recent years suggests reduced recruitment, as does the fact elk are not pioneering into unoccupied habitats as they once were. However, while adequate harvest may be achieved south of I-90, poor success by hunters pursuing female elk in HA 116 is could be allowing that portion of the herd to grow. This stems from a few landowners restricting access to the majority of elk during the hunting season. But, it is difficult to gauge total take and the potential rate of increase north of I-90 because a substantial portion of HA 116 was moved into General License HA 129 in 2008. Due to harvest survey constraints, there is no way to determine how many elk are being harvested in the former part of HA 116 which is now in HA 129. Consequently, the bulk of tooth age data are returned from HA 1 and 117, any decrease in recruitment should only be ascribed south of I-90.

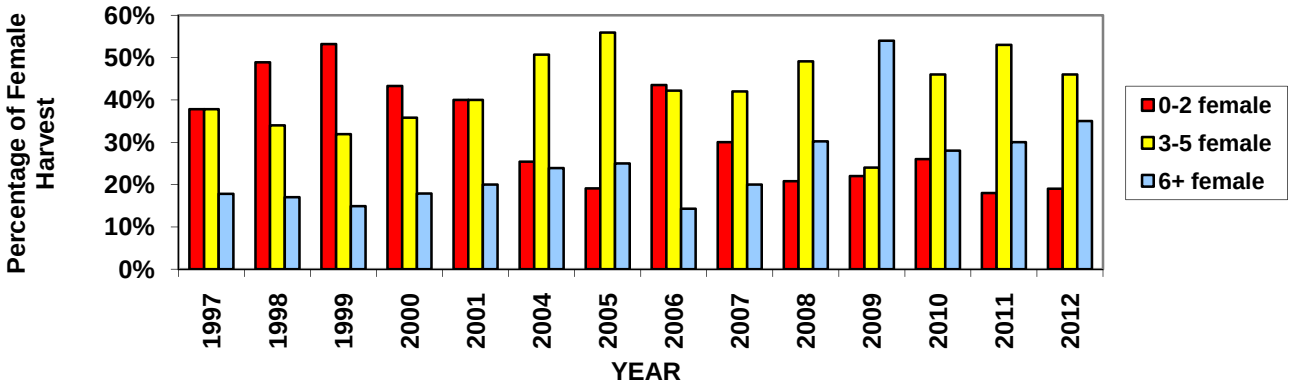


Figure 2. Relative percentages of various age classes of female elk harvested (1997 – 2012).

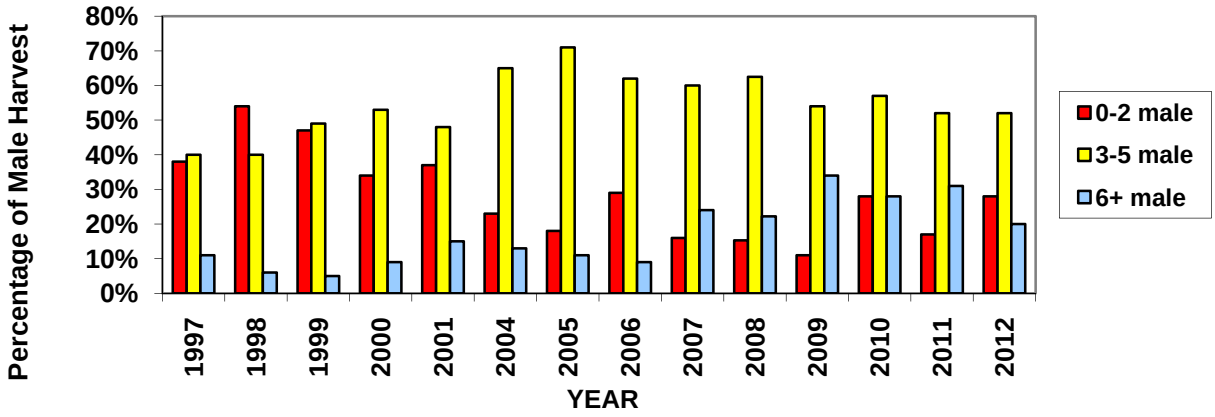


Figure 3. Relative percentages of various age classes of male elk harvested (1997 – 2012).

Limited quota license issuance and harvest are positively correlated in this herd unit. Between 1992 and 2002, license issuance increased exponentially while harvest increased linearly. Between 2002 and 2010 changes in harvest were not as disparate with changes in license issuance. But, over the past two years, license issuance again has substantially outpaced increases in harvest. Consequently, hunter success has dropped. Overall, the average rate of increase in license issuance since 1995 has been about 160% that of harvest (Figure 4).

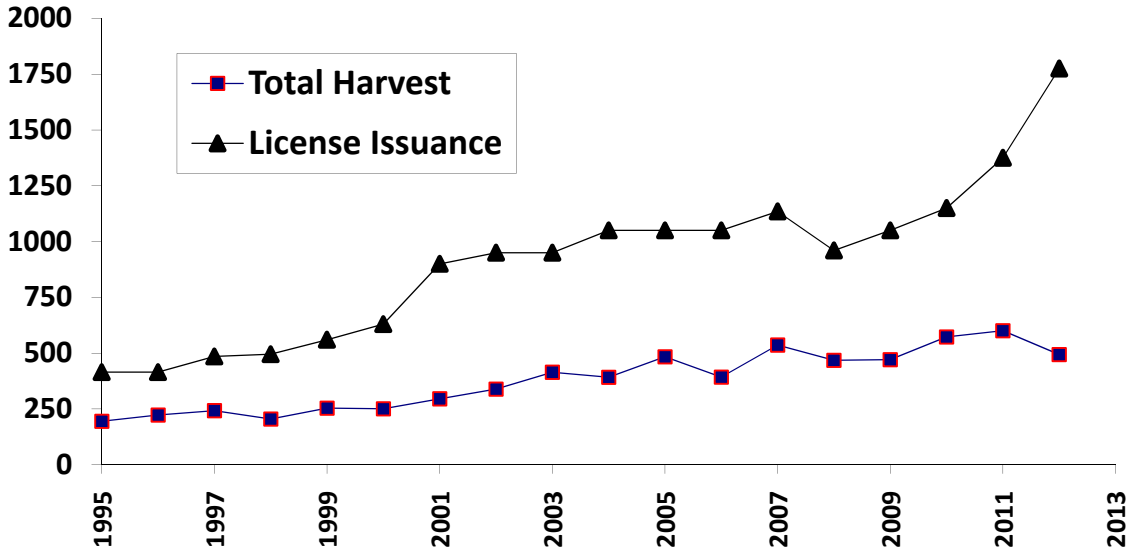


Figure 4. Limited quota license issuances & elk harvest in the Black Hills herd unit (1996 – 2012). Note, in 2008 large portions of Hunt Areas 116 & 117 were put in General License Hunt Area 129.

Access to private land for hunting remains limited, and field personnel are having great difficulty placing the increased number of hunters, many of whom make repeated phone calls to local game managers and landowners without securing a place to hunt.

Given average yearling recruitment based upon tooth age data, and assuming a pre-season herd composition of 40 bulls per 100 cows and 47 calves per 100 cows (based on SDGF&P data), the 2012 estimated harvest of 515 elk would have removed the annual recruitment of yearlings from a total population of about 4,400 elk. As such, the 2012 harvest probably served to keep this elk herd in check or reduce it, because it is unlikely the Wyoming portion of the Black Hills currently harbors in excess of 4,000 elk.

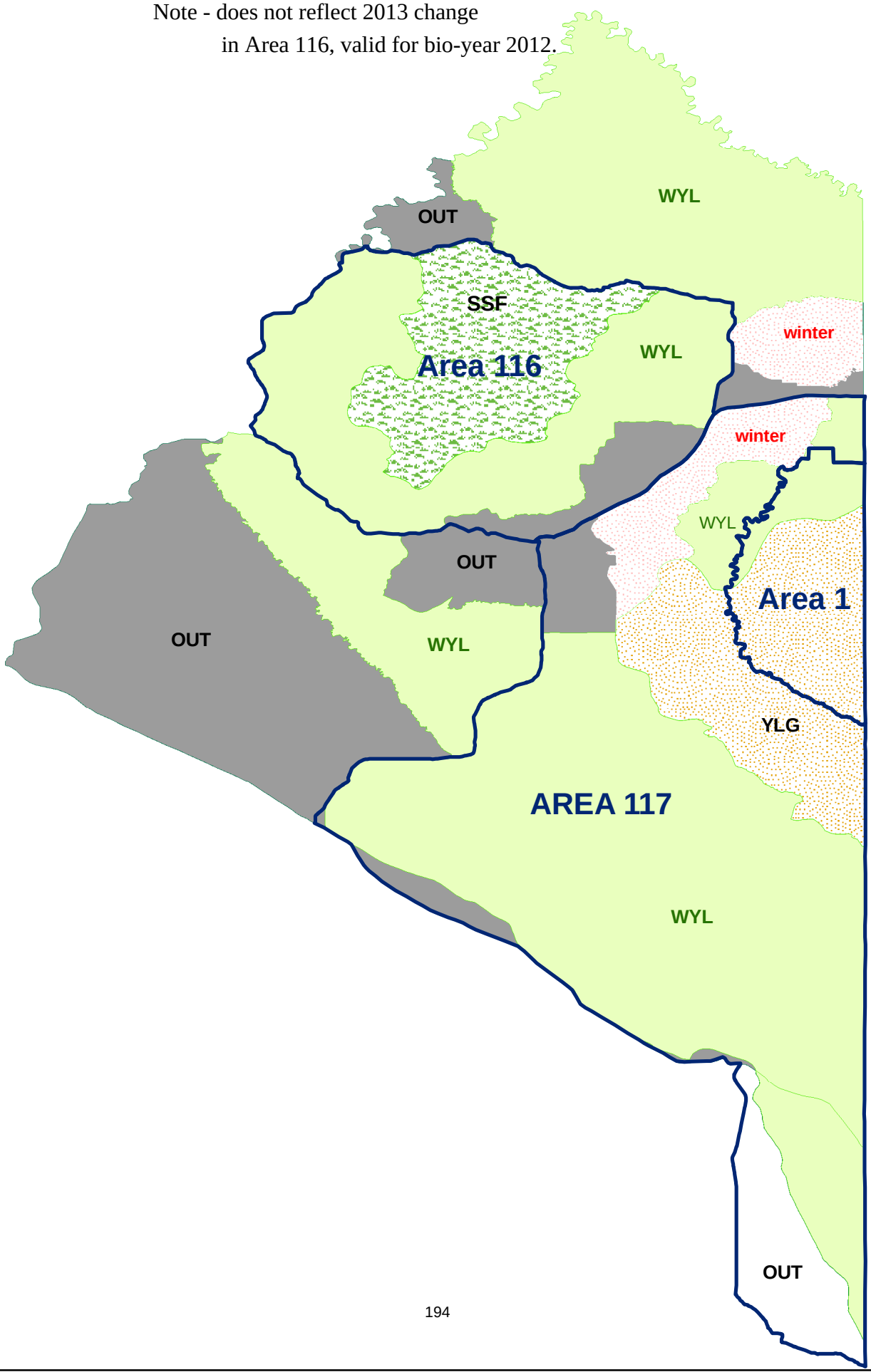
POPULATION: Despite the lack of a population estimate, indications are elk numbers increased quite a bit over the past 30 years. The population appeared to increase rapidly during the 1990's and early part of the next decade when elk significantly expanded their distribution. Silvicultural practices and wildfires throughout the region have created habitat favorable for elk. Although habitat changes have favored elk in recent years, elk have not continued to pioneer into previously unoccupied areas. Harvest statistics and tooth age data also suggest population growth may have been curbed recently, at least south of Interstate Highway 90 (I-90). Given the high quality habitat in the region and limited access to hunt elk on private land, this population will likely continue to grow in areas where limited hunter take, due to access constraints, thwarts efforts to augment harvest.

MANAGEMENT SUMMARY: Changes implemented for the 2013 Black Hills elk hunting season consisted of redefining HA 116 to include all of the lands within Wyoming's Black Hills ecosystem previously enrolled in HA 116 and HA 129. This "new" Hunt Area will be hunted under a combination of General Licenses, and type 6 and 8 cow/calf tags. Because hunter success and satisfaction have dropped south of I-90, we have reduced issuance of all license types in HA 1 and HA 117. Based on past experience, this should not negatively impact harvest here, as success was much reduced in 2012.

Given hunter success rates based upon the mean of 2011 and 2012 figures, the 2013 harvest should result in about 625 elk taken. This harvest estimate is predicated on an approximation of the number of elk to be harvested in the revised HA 116 on General Licenses. However, the long season for antlerless elk hunting in Hunt Areas 116 and 117 (five and a half months) could increase antlerless harvest above predicted values. This is because the collection and analysis of harvest survey data is timed such that we may not adequately capture very late season harvest of elk. If projected harvest levels are reached, elk numbers may decline south of I-90, while elk numbers are anticipated to stabilize or could grow slightly north of the Interstate. Based on estimated herd composition and recruitment rates, a harvest of 625 elk would remove the annual recruitment from a herd of about 5,350 elk.

Black Hills Elk Herd (EL740)

Note - does not reflect 2013 change
in Area 116, valid for bio-year 2012.



2012 - JCR Evaluation Form

SPECIES: Elk

PERIOD: 6/1/2012 - 5/31/2013

HERD: EL741 - LARAMIE PEAK/MUDDY MOUNTAIN

HUNT AREAS: 7, 19

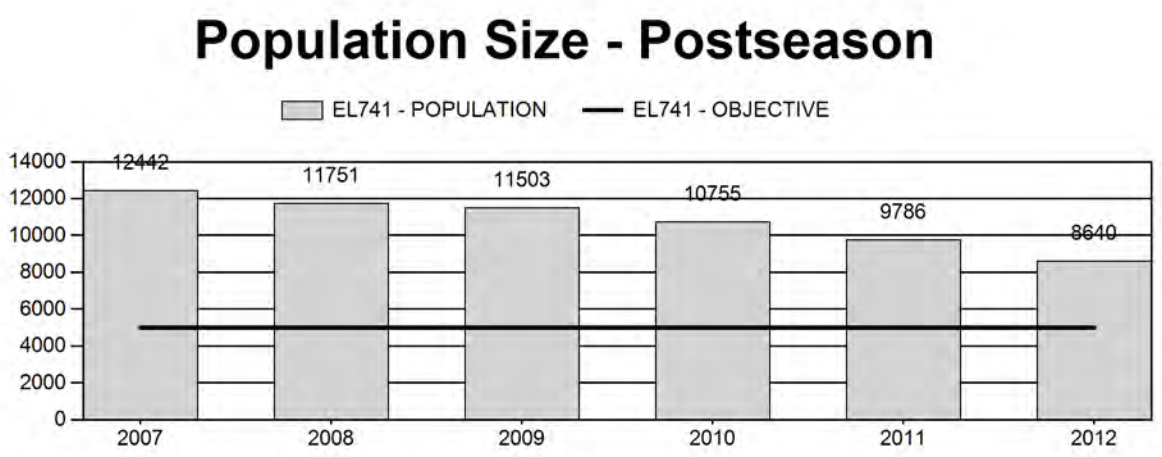
PREPARED BY: HEATHER O'BRIEN

	2007 - 2011 Average	2012	2013 Proposed
Population:	11,247	8,640	7,362
Harvest:	2,307	2,275	2,630
Hunters:	4,150	4,506	4,600
Hunter Success:	56%	50%	57%
Active Licenses:	4,236	4,557	4,800
Active License Percent:	54%	50%	55%
Recreation Days:	32,368	35,334	35,000
Days Per Animal:	14.0	15.5	13.3
Males per 100 Females	33	38	
Juveniles per 100 Females	42	28	

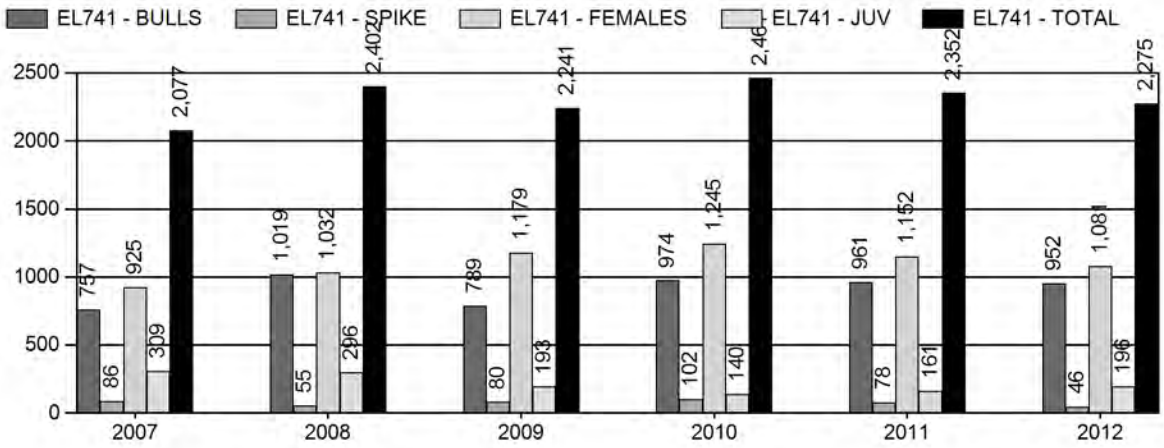
Population Objective:	5,000
Management Strategy:	Special
Percent population is above (+) or below (-) objective:	73%
Number of years population has been + or - objective in recent trend:	12
Model Date:	5/6/2013

Proposed harvest rates (percent of pre-season estimate for each sex/age group):

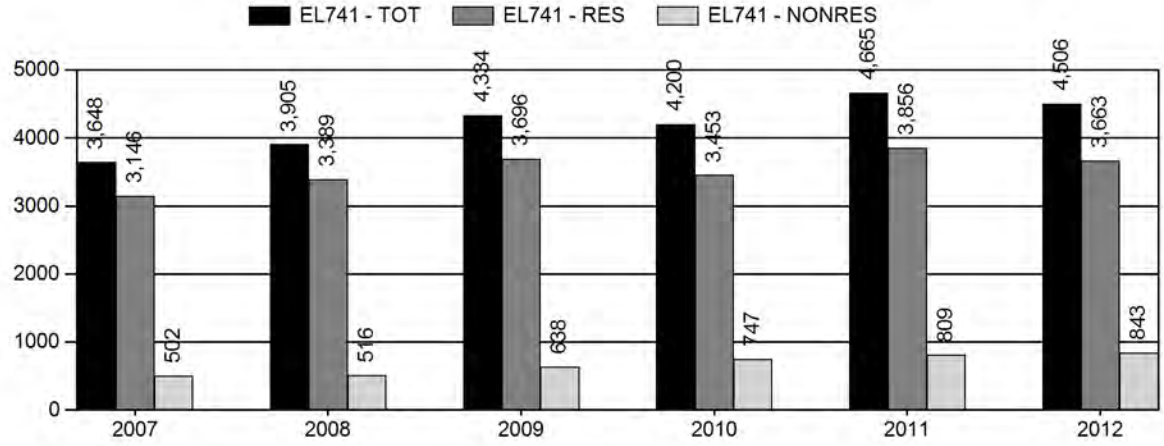
	JCR Year	Proposed
Females ≥ 1 year old:	19.4%	26.9%
Males ≥ 1 year old:	32.5%	40.9%
Juveniles (< 1 year old):	12.1%	10.9%
Total:	20.4%	25.6%
Proposed change in post-season population:	-11.8%	-14.8%



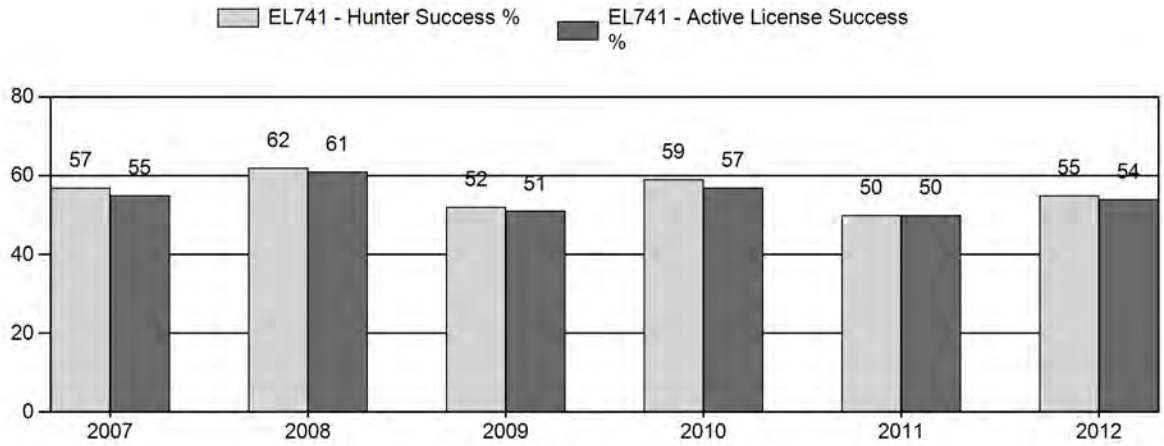
Harvest



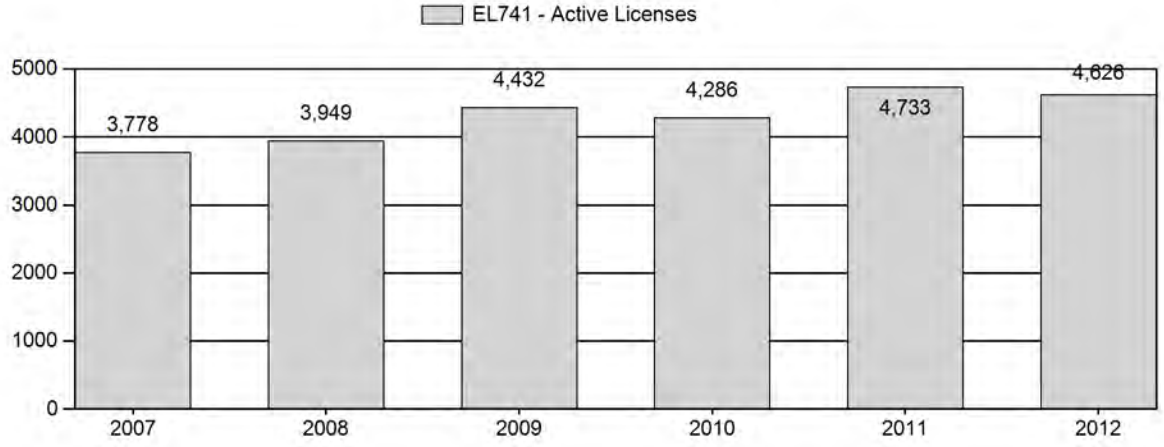
Number of Hunters



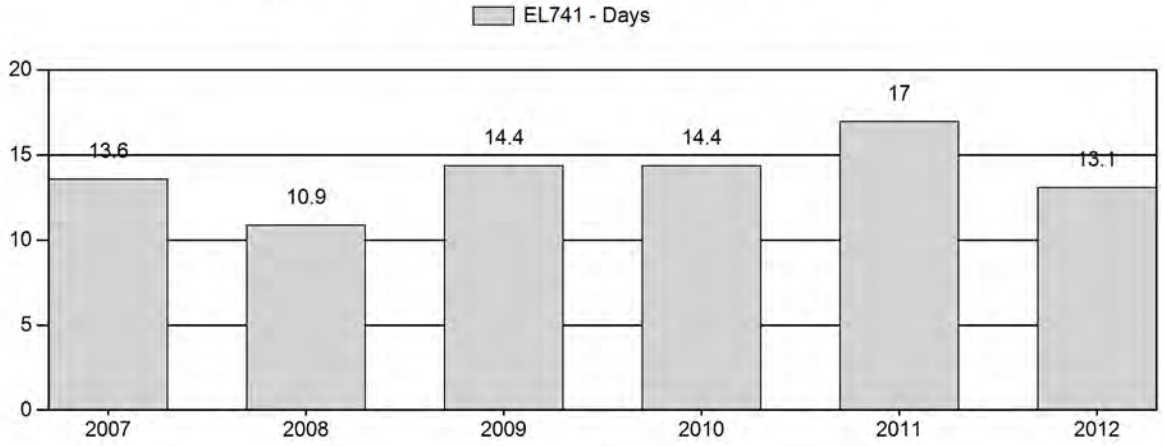
Harvest Success



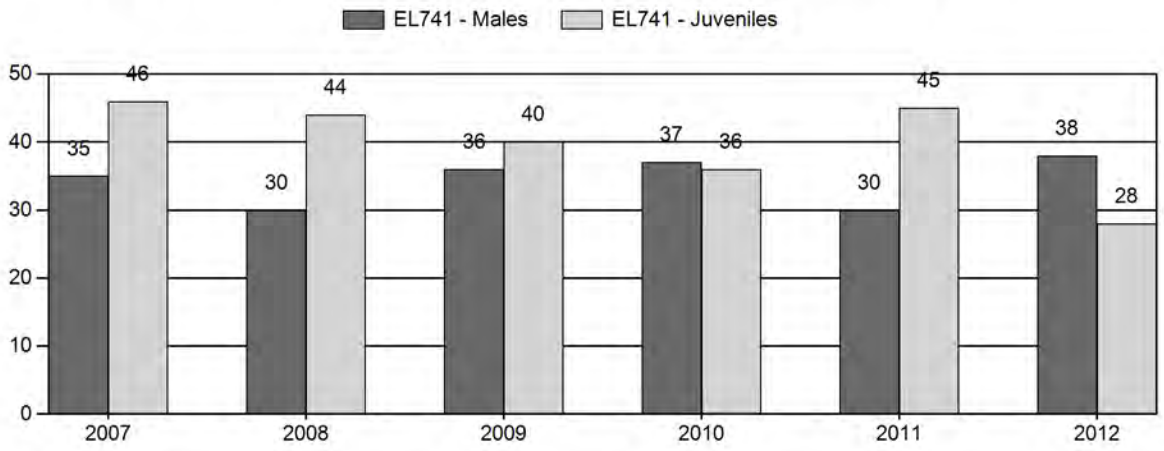
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2007 - 2012 Postseason Classification Summary

for Elk Herd EL741 - LARAMIE PEAK/MUDDY MOUNTAIN

		MALES				FEMALES		JUVENILES				Males to 100 Females				Young to		
Year	Post Pop	Ylg	Adult	Total	%	Total	%	Total	%	Tot Cls	Cls Obj	Yling	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2007	12,442	273	412	685	19%	1,973	55%	899	25%	3,557	748	14	21	35	± 2	46	± 2	34
2008	11,751	297	512	809	17%	2,720	57%	1,208	26%	4,737	679	11	19	30	± 1	44	± 2	34
2009	11,662	259	572	831	21%	2,281	57%	908	23%	4,020	607	11	25	36	± 2	40	± 2	29
2010	10,946	475	639	1,114	21%	3,020	58%	1,094	21%	5,228	545	16	21	37	± 1	36	± 1	26
2011	10,000	324	548	872	17%	2,890	57%	1,298	26%	5,060	539	11	19	30	± 1	45	± 1	35
2012	8,523	143	362	505	23%	1,334	60%	379	17%	2,218	617	11	27	38	± 2	28	± 2	21

2013 HUNTING SEASONS
LARAMIE PEAK MUDDY MOUNTAIN ELK (EL741)

Hunt Area	Type	Date of Seasons Opens	Closes	Quota	Limitations
7	1	Oct. 15	Nov. 20	1,750	Limited quota licenses; any elk
		Nov. 21	Dec. 31		Unused Area 7 Type 1 licenses valid for antlerless elk
	4	Oct. 15	Dec. 31	1,250	Limited quota licenses; antlerless elk
	6	Aug. 15	Oct. 14	1,750	Limited quota licenses; cow or calf valid in those portions of Area 7 in Platte County and on private land in Albany County
		Oct. 15	Dec 31		Unused Area 7 Type 6 licenses valid in the entire area
	7	Jan. 1	Jan. 31	250	Limited quota licenses; cow or calf
	8	Aug. 12	Aug. 31	50	Limited quota licenses; cow or calf valid off national forest in that portion of Area 7 in Converse County
19	1	Oct. 1	Oct. 14	150	Limited quota licenses; any elk
	2	Nov. 1	Nov. 20	150	Limited quota licenses; any elk
	4	Oct. 1	Oct. 14	125	Limited quota licenses; antlerless elk
	5	Nov. 1	Dec. 31	125	Limited quota licenses; antlerless elk
	6	Oct. 1	Oct. 14	200	Limited quota licenses; cow or calf
		Nov. 1	Dec. 31		Unused Area 19 Type 6 licenses
		Nov. 21	Dec. 31		Unused Area 19 Type 1, Type 2, and Type 4 licenses valid for antlerless elk
Archery		Sept. 1	Sept. 30		Refer to licenses and type limitations in Section 3.

Hunt Area	Type	Quota change from 2012
7	1	+250
	4	0
	6	0
	7	+200
	8	0
19	1	0
	2	0
	4	0
	5	0
	6	0
Total	1	**+250**
	7	**+200**

Management Evaluation

Current Postseason Population Management Objective: 5,000

Management Strategy: Special

2012 Postseason Population Estimate: 8,600

2013 Proposed Postseason Population Estimate: 7,400

The Laramie Peak / Muddy Mountain Elk Herd Unit has a postseason population management objective of 5,000 elk. The herd is managed using the special management strategy, with a goal of maintaining postseason bull ratios between 30-40 bulls per 100 cows and a high percentage of branch-antlered bulls in the male harvest segment. The objective and management strategy were last revised in 2001, and will be formally reviewed again in 2013.

Herd Unit Issues

Hunting access within the herd unit is variable, with a mix of national forest, state lands, and private lands. The addition of walk-in and hunter management areas greatly expands access to hunting opportunity within the herd unit as well. Landowners offer varying levels of access to hunting. While most landowners offer some form of access – whether it be free or fee hunting – there are a few ranches that offer little access. These areas tend to harbor high numbers of elk that are inaccessible during hunting seasons. The main land use within the herd unit is traditional ranching and grazing of livestock; however several properties in the herd unit have become "non-traditional" in that they are owned by individuals who do not make a living by ranching their lands. Industrial-scale developments are minimal within this herd unit, though there is potential for the expansion of wind energy development. Chronic Wasting Disease is present in this herd at low prevalence (8% in 2012 hunter-harvested elk).

Weather & Habitat

The winter of 2011-2012 was mild with below average snow accumulations and relatively warm temperatures. The summer and fall of 2012 and early winter of 2013 were extremely dry with above average temperatures. During the same time period, forage growth, forage quality, and available water were well below average. Fires were also quite prevalent in the herd unit during the 2012 season, and some portions of the population were forced out of their summer ranges and into adjacent areas. Elk were likely crowded onto marginal habitat following several larger fires. The combined drought and fire events resulted in very poor calf ratios (28:100) observed during 2012 postseason classification surveys. While habitat conditions were extremely poor in 2012, mild conditions and lack of snow allowed elk to remain more dispersed and at higher elevations for the first part of the 2012-2013 season.

Field Data

Calf ratios are typically in the 40s per 100 cows for the Laramie Peak / Muddy Mountain Elk Herd. While calf survival can be variable from year to year, adult elk in this herd are thought to have rather high rates of survival as there are few natural predators and little mortality from disease and winter weather. Prior to 2005, antlerless license issuance was not adequate to keep up with the production of this herd. Since then, antlerless license issuance has continued to increase, and the population has begun to decrease as harvest pressure on cows has greatly intensified. In 2012, the calf ratio reached a record low of only 28 calves per 100 cows. At the same time, a record number of antlerless licenses were issued, and a record number of cows were harvested. While the low calf ratio of 2012 will contribute to population decline, continued high license issuance and harvest of cows will be necessary to further reduce this herd toward objective.

Bull ratios for the Laramie Peak / Muddy Mountain Herd historically average in the mid-30s per 100 cows, though there have been years where the ratio has dropped below special management limits into the 20s. Issuance of Type 1 any elk licenses has consistently increased in the herd unit along with population growth, and has remained high since 2009. In 2011, it appeared that high Type 1 license issuance may have been taking its toll, as the observed bull ratio dropped to 30 per 100 cows. Despite the drop in license issuance in 2012, total bull harvest actually increased in 2012. Improved access resulting from lack of snow, reduced hunter crowding, and/or changes in elk distribution may have influenced this increase in harvest. Despite the higher harvest in 2011, the 2012 the observed bull ratio was 38 per 100 cows – well within special management parameters.

Harvest Data

License success in this herd unit is typically in the 50th percentile. Hunter days per animal have generally increased since 2008, as the population has dropped in size and more effort is necessary to harvest an elk. It should be noted that days per animal can also be high in this herd unit as hunters have high expectations regarding bull quality, and will exert more effort in finding a mature bull. Days per animal dropped markedly in 2012 however, indicating that hunters had an easier time compared to the 2009-2011 seasons. Again, drought and fire conditions may have changed the distribution of elk in 2012, and mild winter conditions made accessing higher elevations easier for hunters. Overall harvest success in 2012 (51%) was slightly lower than the average harvest success of the previous ten years (55%).

Population

The 2012 postseason population estimate was approximately 8,500 and trending downward from an estimated high of 12,300 elk in 2005. Postseason classification data and harvest data are applied to the model to predict population size and trends for this herd. No sightability or other population estimate data are currently available to further align the model.

The "Time-Specific Juvenile Survival – Constant Adult Survival" (TSJ,CA) spreadsheet model was selected to represent the Laramie Peak / Muddy Mountain Herd Unit. This model seemed the most representative of herd dynamics, as it selects for higher juvenile survival during years when field personnel observed more favorable environmental and habitat conditions, particularly from 2004-2009. The simpler models (CJ,CA and SCJ,CA) select the lowest value for juvenile survival, which does not seem feasible for this herd. The TJS,CS,MSC model was not considered for the Laramie Peak / Muddy Mountain Herd, since it does not have a high level of natural predation. The other three models produce trends that seem representative for this herd, but the CJ,CA and SCJ,CA models estimate a population size that is unrealistically high. Surprisingly, the TSJ,CA model has the lowest AIC of all the models, but all models score similarly so the difference in AIC is unimportant in model selection for this herd. The TSJ,CA model appears to be the best representation relative to the perceptions of managers on the ground, and follows trends with license issuance and harvest success. Overall, this model is of fair quality.

Management Summary

Season dates for this herd have changed from year to year, and in general have been liberalized over time to maximize harvest and reduce damage on agricultural fields. Season dates will be similar for the 2013 season, with a couple of minor changes. Area 7-Type 6 licenses will be

valid earlier in Platte and Albany Counties to address damage to agricultural fields on private lands, and all types except Type 7 licenses will close on December 31st. Area 7-Type 7 licenses will be valid in January only, so that managers can better direct these hunters to areas where landowners are providing access for late season elk hunting. Area 7-Type 1 licenses will be increased back to 1,750, to increase opportunity for bull elk hunting. Access is predicted to be similar in 2013 to previous years. Goals for 2013 are to continue reduction of the herd towards objective, to maintain bull ratios within special management limits, maintain good harvest success, and reduce elk damage to agricultural fields.

If we attain the projected harvest of 2,630 elk with average calf ratios, this herd will decline further toward objective. The predicted 2013 postseason population size of the Laramie Peak / Muddy Mountain Elk Herd is approximately 7,400 animals.

INPUT	
Species:	Elk
Biologist:	Heather O'Brien
Herd Unit & No.:	EL741 Laramie/Muddy
Model date:	02/21/12

☐ Clear form

MODELS SUMMARY		Fit	Relative AICc	Check best model to create report	Notes
CJ,CA	**Constant Juvenile & Adult Survival**	373	382	☐ CJ,CA Model	
SCJ,SCA	**Semi-Constant Juvenile & Semi-Constant Adult Survival**	373	382	☐ SCJ,SCA Mod	
TSJ,CA	**Time-Specific Juvenile & Constant Adult Survival**	217	336	☐ TSJ,CA Model	
TSJ,CA,MSC	**Time-Specific Juv, Constant Adult Survival, Male survival coefficient**	183	315	☐ TSJ,CA,MSC Model	

Population Estimates from Top Model

Year	Posthunt Population Est.		Trend Count	Predicted Prehunt Population				Predicted Posthunt Population				Objective
	Field Est	Field SE		Juveniles	Total Males	Females	Total	Juveniles	Total Males	Females	Total	
1993				2661	1155	4772	8588	2581	766	4480	7826	5000
1994				2192	1396	5035	8623	2118	1057	4672	7847	5000
1995				1919	1565	5108	8592	1864	1165	4831	7859	5000
1996				2058	1607	5200	8866	1987	1208	4642	7836	5000
1997				2296	1788	5153	9236	2160	1198	4863	8221	5000
1998				2611	2200	5792	10603	2478	1716	5230	9424	5000
1999				2303	2301	5745	10349	2218	1803	5249	9269	5000
2000				2491	2321	5698	10510	2354	1765	5163	9282	5000
2001				2904	2728	6059	11690	2830	2165	5653	10647	5000
2002				2363	2829	6247	11439	2257	2124	5763	10143	5000
2003				2879	3153	6720	12752	2690	2380	6224	11293	5000
2004				2839	3005	6772	12615	2718	2364	6278	11360	5000
2005				3241	3340	7175	13757	3110	2625	6375	12110	5000
2006				2710	3525	7199	13434	2546	2577	6437	11560	5000
2007				3302	3735	7517	14554	2962	2808	6500	12269	5000
2008				3103	3772	7390	14264	2778	2590	6254	11622	5000
2009				2661	3858	7449	13968	2449	2902	6152	11503	5000
2010				2263	4007	7192	13462	2109	2824	5822	10755	5000
2011				2488	3473	6412	12373	2311	2330	5145	9786	5000
2012				1622	3381	6140	11143	1406	2283	4950	8640	5000
2013				1830	2906	5519	10255	1610	1718	4034	7362	5000
2014												5000
2015												5000
2016												5000
2017												5000
2018												5000
2019												5000
2020												
2021												
2022												
2023												
2024												
2025												

Survival and Initial Population Estimates

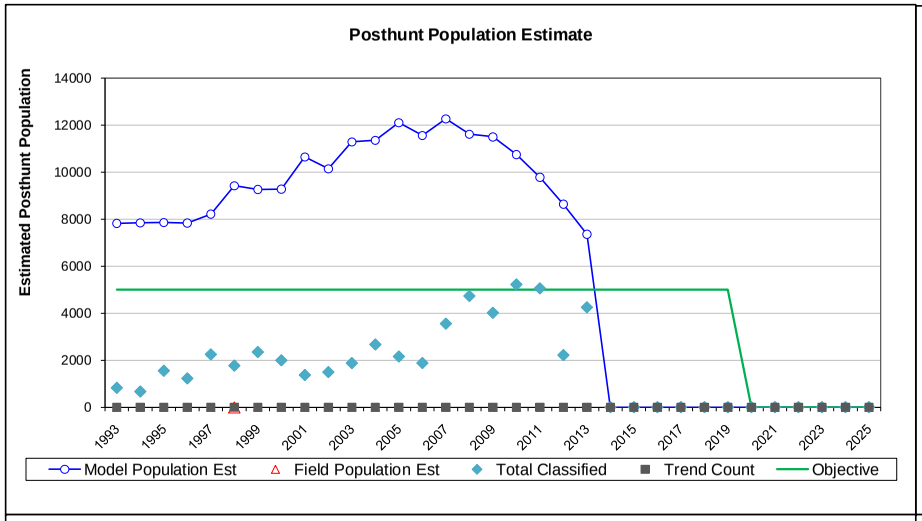
Year	Annual Juvenile Survival Rates			Annual Adult Survival Rates		
	Model Est	Field Est	SE	Model Est	Field Est	SE
1993	0.50			0.98		
1994	0.50			0.98		
1995	0.50			0.98		
1996	0.61			0.98		
1997	0.95			0.98		
1998	0.50			0.98		
1999	0.50			0.98		
2000	0.85			0.98		
2001	0.50			0.98		
2002	0.95			0.98		
2003	0.50			0.98		
2004	0.75			0.98		
2005	0.61			0.98		
2006	0.95			0.98		
2007	0.69			0.98		
2008	0.95			0.98		
2009	0.95			0.98		
2010	0.67			0.98		
2011	0.95			0.98		
2012	0.95			0.98		
2013	0.95			0.98		
2014						
2015						
2016						
2017						
2018						
2019						
2020						
2021						
2022						
2023						
2024						
2025						

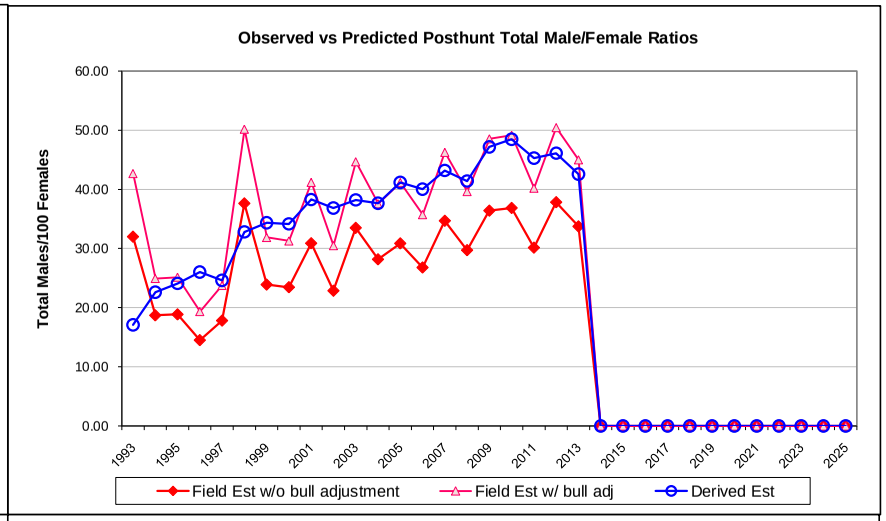
Parameters:	Optim cells
Adult Survival =	0.980
Initial Total Male Pop/10,000 =	0.077
Initial Female Pop/10,000 =	0.448

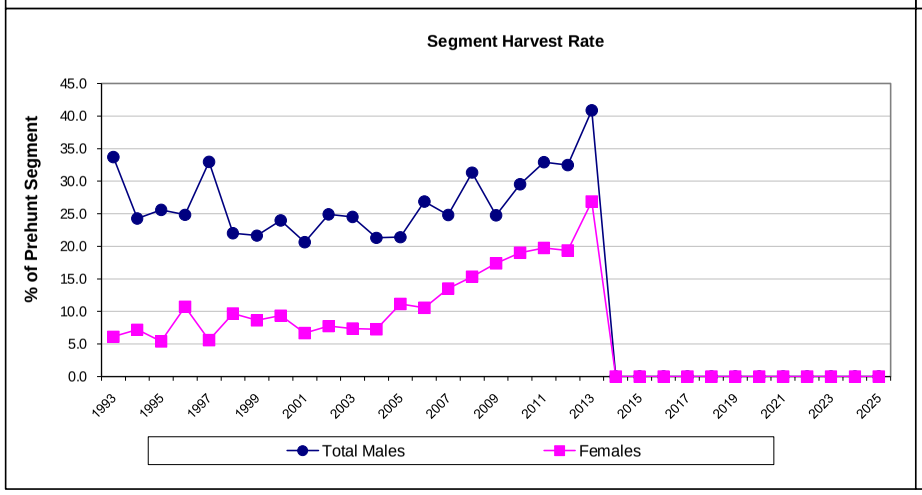
MODEL ASSUMPTIONS	
Sex Ratio (% Males) =	50%
Wounding Loss (total males) =	10%
Wounding Loss (females) =	10%
Wounding Loss (juveniles) =	10%
Total Bulls Adjustment Factor	75%

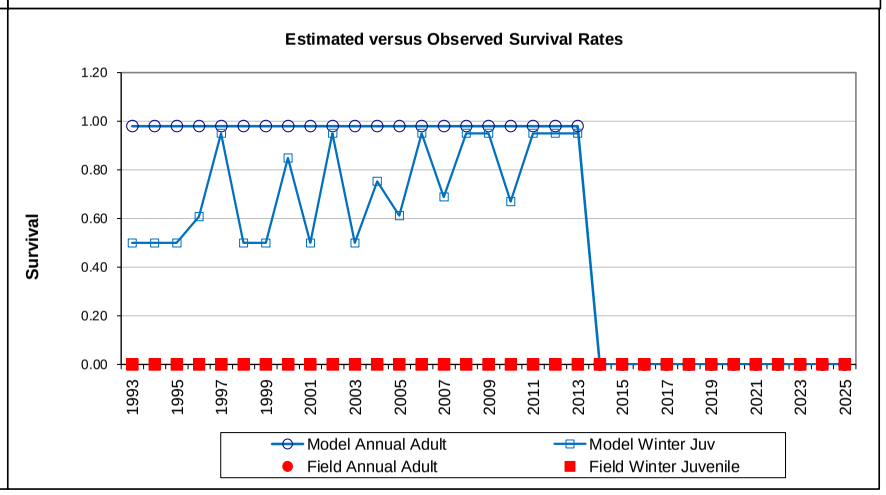
Year	Classification Counts: Juvenile/Female Ratio			Classification Counts: Total Male/Female Ratio				Harvest					Segment Harvest Rate (% of Prehunt Segment)	
	Derived Est	Field Est	Field SE	Derived Est	Field Est w/ bull adj	Field Est w/o bull adj	Field SE	Juv	Yrl males	2+ Males	Females	Total Harvest	Total Males	Females
1993		57.60	4.57	17.09	42.70	32.03	3.12	73	105	249	266	693	33.7	6.1
1994		45.32	4.03	22.62	24.96	18.72	2.34	68	73	235	330	706	24.3	7.2
1995		38.58	2.33	24.11	25.18	18.88	1.51	50	50	314	252	666	25.6	5.4
1996		42.80	2.80	26.02	19.37	14.52	1.46	65	35	328	508	936	24.8	10.7
1997		44.40	2.15	24.64	23.78	17.83	1.23	124	42	494	263	923	33.0	5.6
1998		47.38	2.70	32.81	50.21	37.66	2.33	121	98	342	511	1072	22.0	9.7
1999		42.25	2.06	34.35	31.89	23.92	1.45	78	68	385	451	982	21.7	8.6
2000		45.59	2.37	34.17	31.30	23.47	1.57	124	112	394	486	1116	24.0	9.4
2001		50.07	3.15	38.29	41.22	30.91	2.31	67	91	421	369	948	20.6	6.7
2002		39.15	2.43	36.85	30.51	22.89	1.75	97	71	570	440	1178	24.9	7.7
2003		43.22	2.41	38.24	44.70	33.52	2.05	172	61	642	451	1326	24.5	7.4
2004		43.29	2.00	37.66	37.59	28.20	1.52	110	54	528	449	1141	21.3	7.3
2005		48.79	2.46	41.18	41.19	30.89	1.83	119	103	547	728	1497	21.4	11.2
2006		39.56	2.21	40.04	35.75	26.81	1.73	149	54	807	693	1703	26.9	10.6
2007		45.57	1.83	43.20	46.29	34.72	1.54	309	86	757	925	2077	24.8	13.5
2008		44.41	1.54	41.42	39.66	29.74	1.19	296	55	1019	1032	2402	31.3	15.4
2009		39.81	1.56	47.17	48.58	36.43	1.48	193	80	789	1179	2241	24.8	17.4
2010		36.23	1.28	48.49	49.18	36.89	1.29	140	102	974	1245	2461	29.5	19.0
2011		44.91	1.50	45.29	40.23	30.17	1.17	161	78	961	1152	2352	32.9	19.8
2012		28.41	1.65	46.13	50.47	37.86	1.98	196	46	952	1081	2275	32.5	19.4
2013		39.89	1.51	42.58	45.03	33.77	1.36	200	80	1000	1350	2630	40.9	26.9
2014														
2015														
2016														
2017														
2018														
2019														
2020														
2021														
2022														
2023														
2024														
2025														

FIGURES









Comments:

APPENDIX A:
Tooth Age Data for Laramie Peak / Muddy Mountain Elk

The Laramie Peak / Muddy Mountain Elk Herd Unit (Wyoming Hunt Areas 7 & 19) has historically built a reputation for superior hunting, both in terms of high bull ratios and bull quality. Bull ratios are managed under the special management criteria, with a goal of maintaining 30-40 per 100 cows. Bull quality is monitored annually using cementum annuli tooth age from a sample of hunter-harvested elk and categorical postseason classifications based on antler size.

Tooth age data from the Laramie Peak / Muddy Mountain herd have been collected in nearly all years from 1997-2012. Tooth samples are solicited from both bull and cow elk hunters, as female age data is more representative of a random sample across age classes, while bull age data is biased towards hunter preferences for more mature age classes. Sample size has varied from year to year depending upon hunter response rates. In 2012, a total of 900 "any elk" hunters and 925 antlerless elk hunters in the herd unit were solicited for tooth samples. Of those solicited, 101 returned teeth from bulls and 73 returned teeth from cows. Samples received from calf elk were removed from resulting totals so as not to skew statistics on adult age classes.

Average tooth age of sampled adult male and female elk has remained relatively stable over the past four years (see Figure 1 & 2). In 2012, the average age of female elk sampled was 5.20, and the average age of male elk was 5.44. Median age of females was 4.5 and of males was 5.5. Of those bulls sampled, 61% were age 2-5 and 36% were age 6-10. Of those cows sampled, 53% were age 2-5 and 25% were age 6-10. This disparity between harvested bull age versus harvested cow age illustrates hunter preferences for older aged bulls.

Percentage of bulls aged 6-10 has gradually increased from 2001-2012. License issuance in the herd unit has also increased over the same time period as this population grew steadily through 2007. Managers believe that population size has been gradually decreasing over the past four years, and license issuance has been maintained at a record high during the same time period.

In those same years (2009-2012), more than a third of tooth-sampled bulls were age 6-10 as overall harvest increased, indicating that older age-class bulls have been increasingly available for harvest. This contradicts observed antler class data during the same time period that shows a decline of Class II (6 points on a side or better) bulls in the herd (see Figure 3). This disparity may be due to increased selectivity of hunters for older age-class bulls, compared to the more random sample of bulls surveyed during postseason classification flights. In addition, hunters submitting teeth may be biased towards older age class bulls, as hunters who are pleased with the quality of their animals may be more likely to submit samples. Regardless, one must assume

inherent biases within this sampling scheme apply equally across years. Thus, emerging trends in mean and median ages of sampled bulls warrant discussion.

The increasingly high percentage of older age-class bull elk is a surprising trend, considering that managers believe this herd has been decreasing since 2009. License issuance has remained high, and one would expect it to become more and more difficult to find and harvest older age-class bulls in a declining population. At the same time, average tooth age of sampled cows has slowly decreased since 2007, while license issuance and season length were liberalized. This seems to corroborate the declining trend seen in the population model. Collectively, these data seem to indicate that this herd can continue support a high number of any-elk licenses and a high level of harvest without compromising bull ratios or bull quality. Any observed decline in Class II bulls during postseason classifications may be related more to environmental variables, as it is not borne out in tooth age data. Any-elk license issuance should therefore be maintained until tooth sample data show a decline in the percentage of older age-class bulls, a decline in harvest success, and/or a decline in bull ratios below special management limits.

Figure 1. Tooth-age data analysis for adult bull elk harvested within the Laramie Peak/Muddy Mountain Herd Unit, 1997 - 2012.

	Number of Adult Males per Age Class (Tooth Sampling)																				
Year	**1+**	**2+**	**3+**	**4+**	**5+**	**6+**	**7+**	**8+**	**9+**	**10+**	**11+**	**12+**	**13+**	**14+**	**15+**	**16+**	**17+**	**18+**	**19+**	**20+**	**21+**	**22+**
1997	7	13	5	5	6	2	2	3	0	2	1	0	0	0	0	0	0	0	0	0	0	0
1998	1	16	19	10	10	4	3	2	1	2	1	0	0	0	0	0	0	0	0	0	0	0
1999	20	26	39	24	16	9	8	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0
2000	22	36	41	28	24	13	6	1	3	1	1	0	0	0	0	1	0	0	0	0	0	0
2001	15	22	27	29	14	10	3	3	1	0	2	2	0	0	0	0	0	0	0	0	0	0
2004	7	8	16	19	6	10	5	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0
2005	6	3	27	16	10	11	6	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0
2007	1	11	24	18	12	12	8	3	0	0	1	1	0	0	0	1	0	0	0	0	0	0
2008	4	2	19	24	22	17	12	3	2	1	1	0	0	0	0	0	0	0	0	0	0	0
2010	4	3	16	27	32	27	13	2	1	2	5	1	0	0	0	0	0	0	0	0	0	0
2011	7	9	11	19	25	24	7	4	6	3	3	0	0	0	0	0	0	0	0	0	0	0
2012	2	9	9	22	22	20	9	3	4	0	1	0	0	0	0	0	0	0	0	0	0	0

Year	1	2-5	6-10	11-12	13+	N	Avg Age
1997	7	29	9	1	0	46	**4.41**
1998	1	55	12	1	0	69	**4.12**
1999	20	105	20	1	0	146	**3.91**
2000	22	129	24	1	1	177	**3.99**
2001	15	92	17	4	0	128	**4.17**
2004	7	49	19	1	0	76	**4.48**
2005	6	56	20	1	0	83	**4.51**
2007	1	65	23	2	1	92	**4.58**
2008	4	67	35	1	0	107	**5.01**
2010	4	78	45	6	0	133	**5.33**
2011	7	64	44	3	0	118	**5.35**
2012	2	62	36	1	0	101	**5.44**

	Percentages				
Year	**1**	**2-5**	**6-10**	**11-12**	**13+**
1997	15%	63%	20%	2%	0%
1998	1%	80%	17%	1%	0%
1999	14%	72%	14%	1%	0%
2000	12%	73%	14%	1%	1%
2001	12%	72%	13%	3%	0%
2004	9%	64%	25%	1%	0%
2005	7%	67%	24%	1%	0%
2007	1%	71%	25%	2%	1%
2008	4%	63%	33%	1%	0%
2010	3%	59%	34%	5%	0%
2011	6%	54%	37%	3%	0%
2012	2%	61%	36%	1%	0%

Figure 2. Tooth-age data analysis for adult female elk harvested within the Laramie Peak/Muddy Mountain Herd Unit, 1997 - 2011.

	Number of Adult Females per Age Class (Tooth Sampling)																				
Year	**1+**	**2+**	**3+**	**4+**	**5+**	**6+**	**7+**	**8+**	**9+**	**10+**	**11+**	**12+**	**13+**	**14+**	**15+**	**16+**	**17+**	**18+**	**19+**	**20+**	**21+**	**22+**
1997	8	3	5	9	5	1	1	2	1	1	3	0	0	0	0	0	0	0	0	0	0	0
1998	3	14	6	10	6	7	5	2	1	2	1	1	1	0	0	0	1	0	0	0	0	0
1999	14	22	16	20	8	8	6	7	3	1	8	3	3	1	0	0	0	0	0	0	0	1
2000	19	26	21	17	13	11	6	4	6	0	4	3	0	1	2	1	0	0	0	0	1	0
2001	11	15	24	11	15	9	10	5	4	4	3	3	0	0	0	1	0	0	0	0	0	0
2004	8	4	13	8	8	6	3	2	3	0	0	1	0	0	0	0	0	0	0	0	0	0
2005	26	14	39	34	21	14	16	15	4	6	5	5	0	4	4	0	0	1	0	0	0	0
2007	4	7	19	24	7	6	8	5	11	4	5	2	2	1	0	2	1	0	0	0	0	0
2008	8	11	14	14	17	8	11	5	3	2	1	2	3	1	0	2	1	1	0	1	0	0
2010	5	7	14	9	13	9	3	5	3	5	1	1	2	0	1	1	0	0	0	0	0	0
2011	4	4	11	10	14	6	7	6	2	1	0	0	0	0	1	2	0	0	0	0	0	0
2012	10	9	15	8	7	5	4	6	2	1	4	1	1	0	0	0	0	0	0	0	0	0

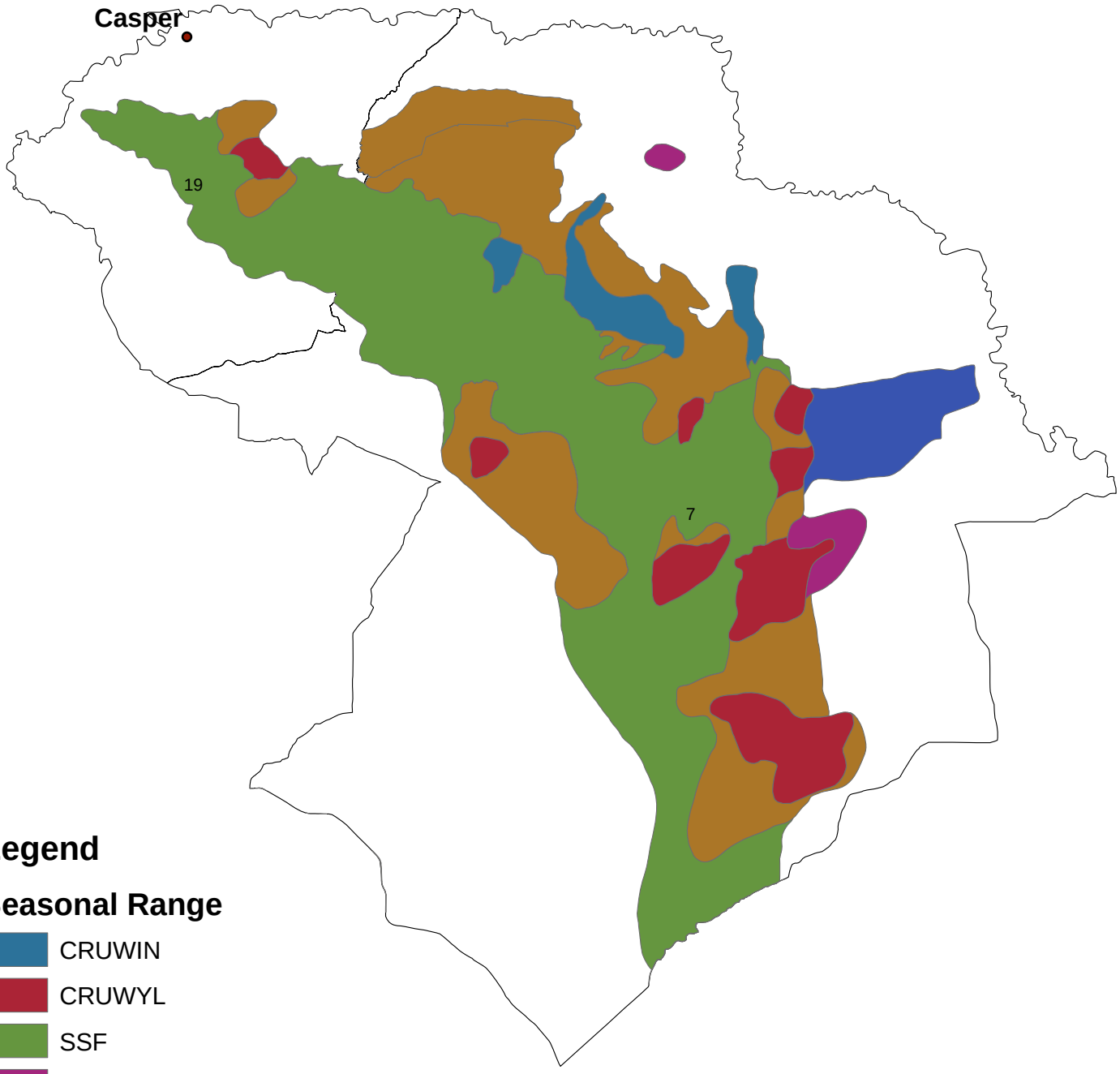
Year	**1**	**2-5**	**6-10**	**11-12**	**13+**	**N**	**Avg Age**
1997	8	22	6	3	0	39	**4.38**
1998	3	36	17	2	2	60	**4.90**
1999	14	66	25	11	5	121	**5.02**
2000	19	77	27	7	5	135	**4.61**
2001	11	65	32	6	1	115	**4.84**
2004	8	33	14	1	0	56	**4.27**
2005	26	108	55	10	9	208	**5.16**
2007	4	57	34	7	6	108	**5.97**
2008	8	56	29	3	9	105	**5.71**
2010	5	43	25	2	4	79	**5.49**
2011	4	39	22	0	3	68	**5.34**
2012	10	39	18	5	1	73	**5.20**

	Percentages				
Year	**1**	**2-5**	**6-10**	**11-12**	**13+**
1997	21%	56%	15%	8%	0%
1998	5%	60%	28%	3%	3%
1999	12%	55%	21%	9%	4%
2000	14%	57%	20%	5%	4%
2001	10%	57%	28%	5%	1%
2004	14%	59%	25%	2%	0%
2005	13%	52%	26%	5%	4%
2007	4%	53%	31%	6%	6%
2008	8%	53%	28%	3%	9%
2010	6%	54%	32%	3%	5%
2011	6%	57%	32%	0%	4%
2012	14%	53%	25%	7%	1%

Figure 3. Antler classification of bull elk from the Laramie Peak/Muddy Mountain Herd Unit, 2008-2012.

Mature Bull Antler Classification									
Bio-Year	Area 7 (N / %)			Area 19 (N / %)			**EL 741 (N / %)**		
	Class I	Class II	Total	Class I	Class II	Total	**Class I**	**Class II**	**Total**
2008	82 (23%)	270 (77%)	352	41 (26%)	119 (74%)	160	**123 (24%)**	**389 (76%)**	**512**
2009	211 (49%)	219 (51%)	430	58 (41%)	84 (59%)	142	**269 (47%)**	**303 (53%)**	**572**
2010	246 (47%)	280 (53%)	526	61 (54%)	52 (46%)	113	**307 (48%)**	**332 (52%)**	**639**
2011	278 (69%)	128 (31%)	406	104 (73%)	38 (27%)	142	**382 (70%)**	**166 (30%)**	**548**
2012	76 (56%)	60 (44%)	136	160 (71%)	66 (29%)	226	**236 (65%)**	**126 (35%)**	**362**

Laramie Peak/Muddy Mountain Elk Herd Unit
(EL741)
Revised May 18, 2010
Hunt Areas 7 & 19



Legend

Seasonal Range

- CRUWIN
- CRUWYL
- SSF
- WIN
- WYL
- YRL

2012 - JCR Evaluation Form

SPECIES: Elk

PERIOD: 6/1/2012 - 5/31/2013

HERD: EL742 - RATTLESNAKE

HUNT AREAS: 23

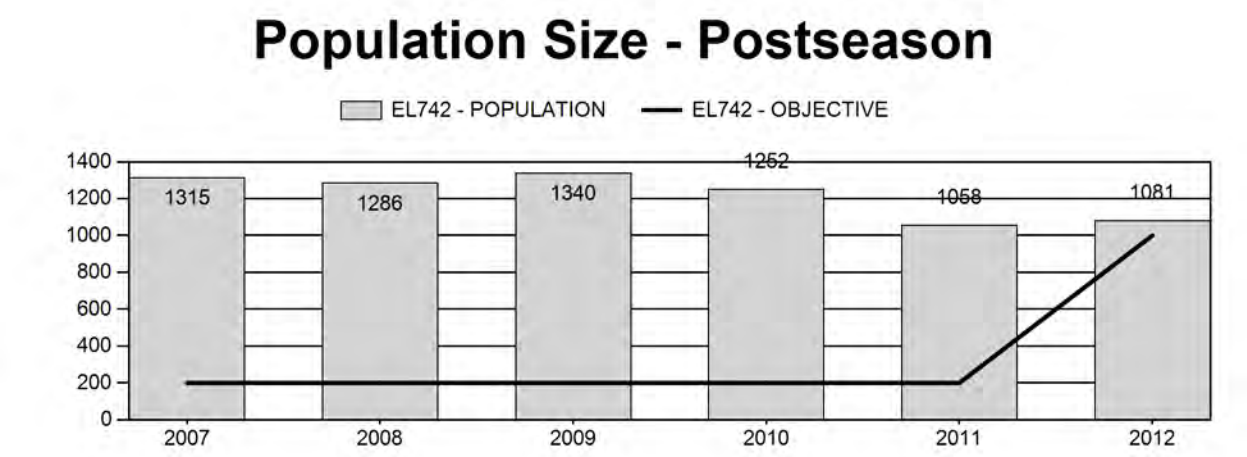
PREPARED BY: HEATHER O'BRIEN

	2007 - 2011 Average	2012	2013 Proposed
Population:	1,250	1,081	1,009
Harvest:	158	117	156
Hunters:	325	388	345
Hunter Success:	49%	30%	45%
Active Licenses:	348	404	390
Active License Percent:	45%	29%	40%
Recreation Days:	2,773	3,906	3,700
Days Per Animal:	17.6	33.4	23.7
Males per 100 Females	40	28	
Juveniles per 100 Females	34	38	

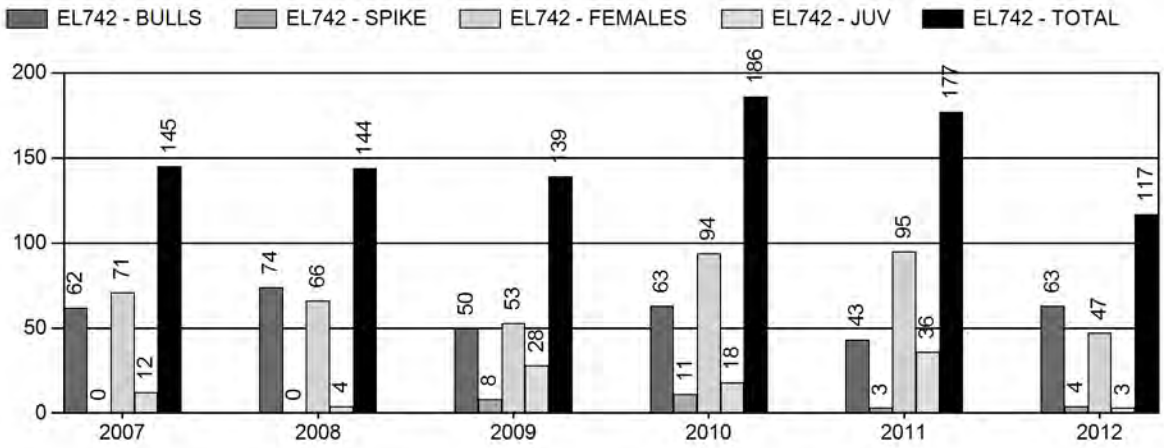
Population Objective:	1,000
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	8%
Number of years population has been + or - objective in recent trend:	22
Model Date:	5/6/2013

Proposed harvest rates (percent of pre-season estimate for each sex/age group):

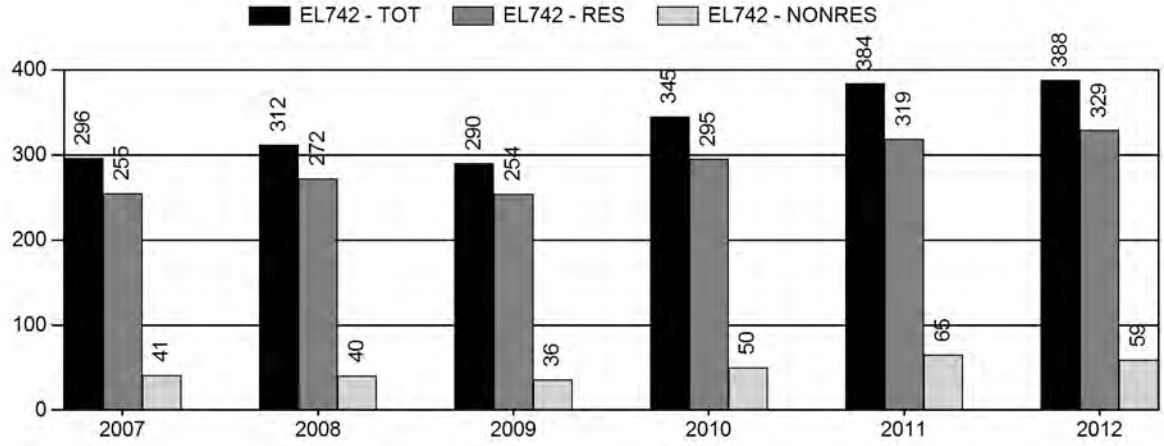
	JCR Year	Proposed
Females ≥ 1 year old:	7.7%	9.9%
Males ≥ 1 year old:	24.4%	31.6%
Juveniles (< 1 year old):	1%	6%
Total:	9.66%	13.2%
Proposed change in post-season population:	-10.6%	-14.6%



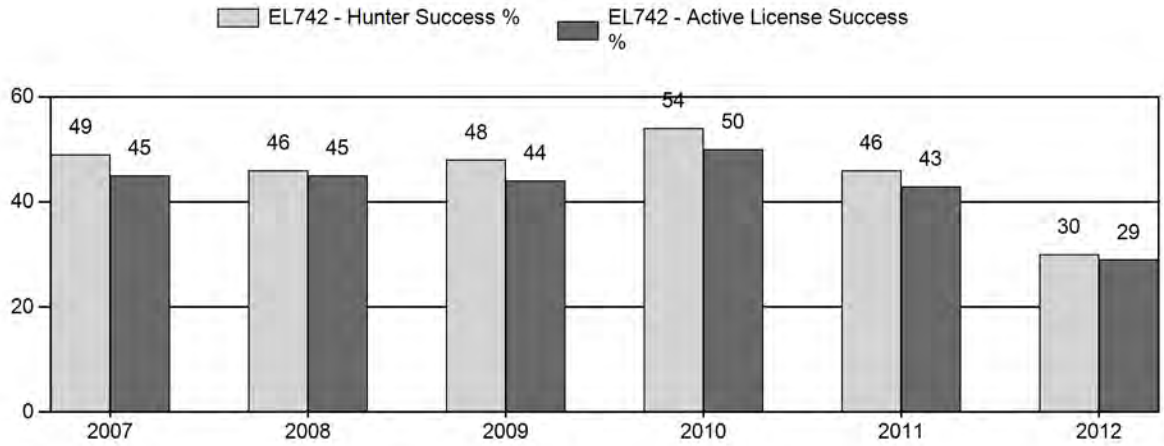
Harvest



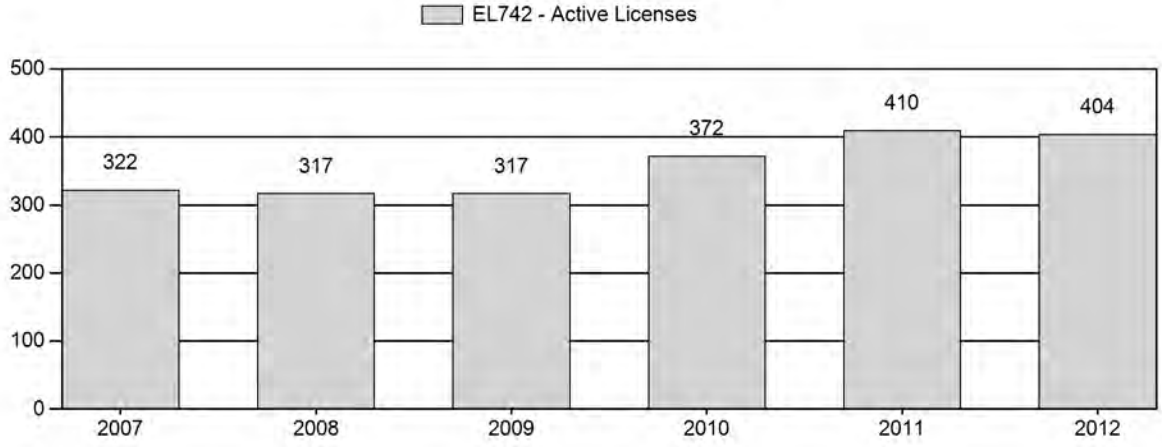
Number of Hunters



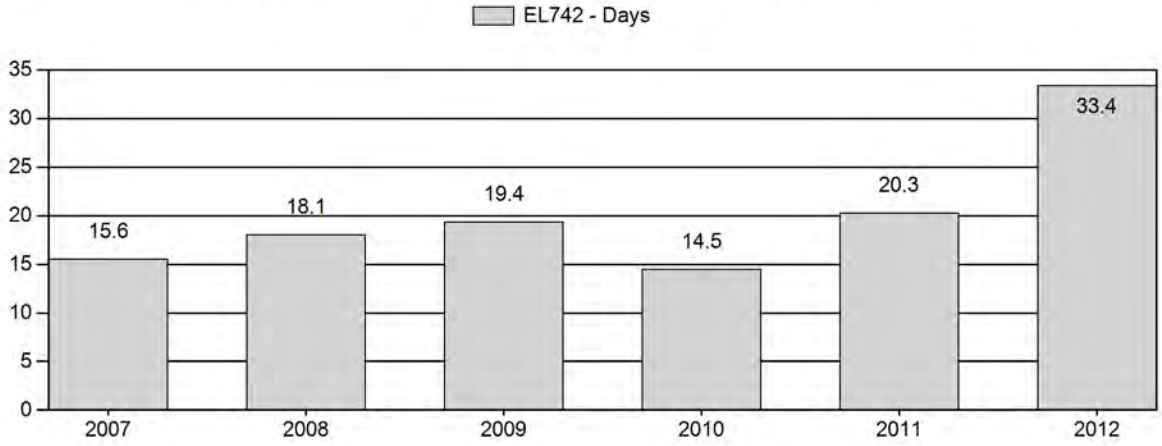
Harvest Success



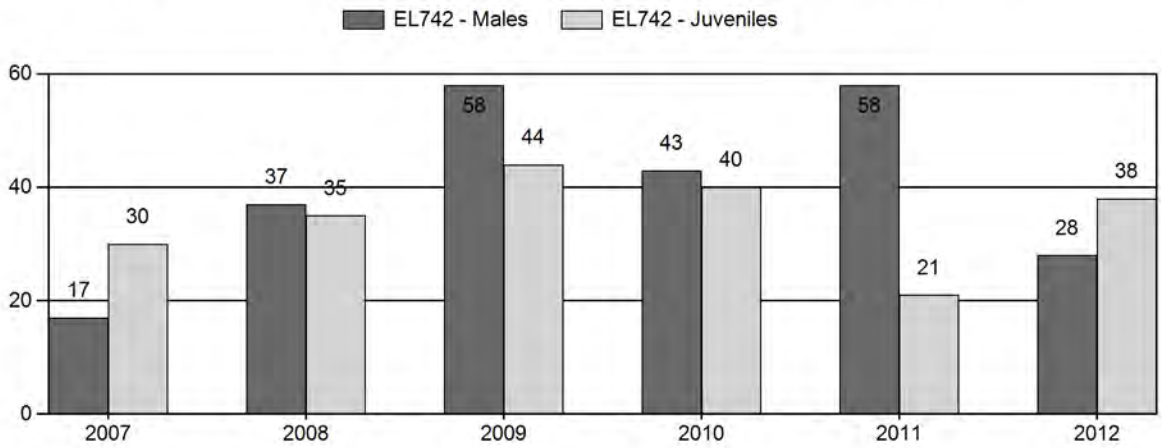
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2007 - 2012 Postseason Classification Summary

for Elk Herd EL742 - RATTLESNAKE

		MALES				FEMALES		JUVENILES				Males to 100 Females				Young to		
Year	Post Pop	Ylg	Adult	Total	%	Total	%	Total	%	Tot Cls	Cls Obj	Yling	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2007	1,317	36	11	47	12%	277	68%	84	21%	408	283	13	4	17	± 3	30	± 4	26
2008	1,286	38	34	72	21%	195	58%	68	20%	335	375	19	17	37	± 6	35	± 5	25
2009	1,342	27	84	111	29%	192	49%	85	22%	388	579	14	44	58	± 7	44	± 6	28
2010	1,255	24	47	71	23%	166	55%	66	22%	303	415	14	28	43	± 7	40	± 6	28
2011	1,061	17	90	107	32%	185	56%	38	12%	330	443	9	49	58	± 7	21	± 4	13
2012	1,076	26	32	58	17%	204	60%	77	23%	339	384	13	16	28	± 4	38	± 5	29

2013 HUNTING SEASONS
RATTLESNAKE ELK (EL742)

Hunt Area	Type	Date of Seasons Opens	Closes	Quota	Limitations
23	1	Oct. 1	Oct. 31	125	Limited quota licenses; any elk
		Nov. 15	Dec. 15		Unused Area 23 Type 1 licenses
	4	Oct. 1	Oct. 31	125	Limited quota licenses; antlerless elk
		Nov.15	Dec. 15		Unused Area 23 Type 4 licenses, also valid in Area 128
	6	Oct. 1	Oct. 31	200	Limited quota licenses; cow or calf
		Nov. 15	Dec. 15		Unused Area 23 Type 6 licenses, also valid in Area 128
Archery		Sept. 1	Sept. 30		Refer to license and type limitations in Section 3

Hunt Area	Type	Quota change from 2012
23	1	0
	4	0
	6	+25
	7	-25

Management Evaluation

Current Postseason Population Management Objective: 1,000
Management Strategy: Recreational
2012 Postseason Population Estimate: 1,100
2013 Proposed Postseason Population Estimate: 1,000

The Rattlesnake Elk Herd Unit has a postseason population management objective of 1,000 elk. The herd is managed using the recreational management strategy, with a goal of maintaining postseason bull ratios of 15-29 bulls per 100 cows. The objective and management strategy were revised in 2012 from a postseason objective of 200 to 1,000. The old objective was antiquated, unreasonable, and inadequate to meet the expectations of hunters, landowners, and managers.

Herd Unit Issues

Hunting access within the herd unit is variable. The majority of occupied elk habitat is accessible for hunting via public land and hunter management area access. However, there is one ranch within the central part of occupied habitat that does not allow any access for hunting. Hunters have expressed frustration when elk take refuge in this area, as they tend to remain there due to low hunter pressure and good forage conditions. The main land use within the herd unit is traditional ranching and grazing of livestock, with isolated areas of oil and gas development. There is the potential for future mining of precious metals and rare earths in the hunt area, but current levels of activity are low. Disease outbreaks are not a concern in this herd unit.

Weather & Habitat

The winter of 2011-2012 was mild with below average snow accumulations and relatively warm temperatures. The summer and fall of 2012 and early winter of 2013 were extremely dry with above average temperatures. While there are no established habitat transects to quantify shrub production or utilization trends in the herd unit, severe drought conditions in 2012 resulted in poor forage growth, poor forage quality, and a general lack of available water. The Rattlesnake Elk Herd seems to have tolerated the drought better than other big game species in the area, as elk were distributed across their normal range and calf ratios were comparable to historic averages.

Field Data

Observed calf ratios are highly erratic in this herd unit due to varying survey conditions and levels of effort across years. Thus it is difficult to correlate changes in population size or make decisions regarding license issuance based on observed calf ratios. Instead managers continue to focus on maximizing cow harvest without over-saturating the area with hunter pressure. Increases in license issuance are not warranted unless access improves and there are no large areas where elk can take refuge from harvest pressure.

Observed bull ratios are also highly variable as a result of variable survey conditions and levels of effort from year to year. Since 2001, observed bull ratios have ranged from as low as 13 to as high as 58 per 100 cows. Years with low observed bull ratios were followed by years with much higher observed ratios; indicating bulls were likely missed during classification surveys in some years, or elk are immigrating/emigrating to and from adjacent hunt areas. Again, license issuance and season structure changes in this herd are not typically made based on observed bull ratios. Instead, seasons are designed to maximize cow harvest and maintain relatively good license success without overcrowding hunters.

Harvest Data

License success in this herd unit is typically in the 40th percentile and is fairly consistent, indicating that opportunity has remained fairly similar across years. Hunter days per animal fluctuate from year to year, but this may be a function of changes in access due to weather and road conditions. The persistence of unattainable elk in the aforementioned private land refugia most certainly contributed to higher hunter days and lower license success in 2012. In years with more severe winter conditions, elk are often forced onto adjacent public lands where they can be more readily harvested.

Population

The 2012 postseason population estimate was approximately 1,100 and decreasing. Postseason classification data and harvest data are applied to the model to predict population size and trends for this herd. No sightability or other population estimate data are currently available to further align the model. Managers are currently discussing the combination of several central Wyoming elk herds, where interchange of animals is known to occur. Modeling larger herds with less interchange should produce higher quality models that predict trends more accurately.

The "Constant Juvenile Survival – Constant Adult Survival" (CJ,CA) spreadsheet model was selected for the postseason population estimate of this herd. This population is difficult to model as it is small in size and appears to have consistent interchange with adjacent herds, thus violating the closed population assumption of the model. High variability in observed bull ratios also render this herd challenging to model. The TSJ,CA model was discarded, as it predicts population sizes that are lower than actual observed survey totals. When juvenile survival was increased in years known to have mild winter conditions, the SCJ,CA model also predicted population sizes that are lower than actual numbers of elk observed. The TSJ,CA,MSC model was not used as it does not seem applicable or necessary for this herd, which does not have elevated predation rates from large carnivores. While the CJ,CA model appears to be the best choice to represent the herd, it should be noted that this model selected for the lowest juvenile and the highest adult constraints, indicating that it is of poor quality. Managers recommend combining this with adjacent herds to account for interchange and to model a more closed population in future years.

Management Summary

Opening day of hunting season in this herd is traditionally October 1st, and closing dates have differed with changing harvest goals from year to year. Season structures have also changed to include split seasons in some years in an attempt to maximize harvest. Input from hunters

following the 2012 season indicated poor bull hunting opportunity. Thus for 2013, season dates are changing from a continuous to a split season, in the hopes that a break in the season will allow time for elk to venture away from refuge areas and become accessible to harvest. The split in season will also result in a later closing date, which increases the possibility that winter weather will push elk off their refuge while the season is still open. Type 7 licenses, which were added in 2010 to target a specific area of damage, will be eliminated as they are no longer needed. Those licenses removed from the Type 7 license will be added to the Type 6 license, which is valid in the whole hunt area. Goals for 2013 are to improve access to elk by modifying season structure, increase harvest on cows, extend opportunity to hunt bulls, and improve overall harvest success.

If we attain the projected harvest of approximately 156 elk and assuming average calf ratios, this herd will maintain itself near objective. The predicted 2013 postseason population estimate for the Rattlesnake Elk Herd is approximately 1,000 animals.

INPUT	
Species:	Elk
Biologist:	Heather O'Brien
Herd Unit & No.:	Rattlesnake
Model date:	03/04/13

☐ Clear form

MODELS SUMMARY		Fit	Relative AICc	Check best model to create report	Notes
CJ,CA	**Constant Juvenile & Adult Survival**	366	375	☐ CJ,CA Model	
SCJ,SCA	**Semi-Constant Juvenile & Semi-Constant Adult Survival**	366	375	☐ SCJ,SCA Mod	
TSJ,CA	**Time-Specific Juvenile & Constant Adult Survival**	202	309	☐ TSJ,CA Model	
TSJ,CA,MSC	**Time-Specific Juv, Constant Adult Survival, Male survival coefficient**	188	307	☐ TSJ,CA,MSC Model	

Population Estimates from Top Model

Year	Posthunt Population Est.		Trend Count	Predicted Prehunt Population				Predicted Posthunt Population				Objective
	Field Est	Field SE		Juveniles	Total Males	Females	Total	Juveniles	Total Males	Females	Total	
1993				208	104	623	935	201	65	604	870	200
1994				332	114	642	1088	327	76	631	1034	200
1995				264	156	700	1120	263	119	680	1062	200
1996				202	182	732	1116	200	127	710	1037	200
1997				338	175	746	1259	335	123	716	1174	200
1998				548	204	786	1538	543	159	755	1457	200
1999				266	292	876	1434	258	252	790	1300	200
2000				369	311	839	1519	337	234	749	1321	200
2001				206	314	819	1339	182	244	757	1183	200
2002				274	284	787	1346	252	230	736	1218	200
2003				344	289	784	1416	333	237	742	1312	200
2004				304	315	811	1430	294	248	761	1303	200
2005				423	317	819	1559	415	262	798	1475	200
2006			786	312	360	886	1559	299	295	801	1396	200
2007			544	250	364	860	1475	237	296	782	1315	200
2008			385	267	350	826	1442	263	268	753	1284	200
2009			858	361	328	804	1493	330	265	745	1340	200
2010			899	302	342	813	1457	282	260	710	1252	200
2011			1037	179	326	766	1270	134	274	650	1058	200
2012			912	237	302	671	1210	234	228	619	1081	1000
2013				234	282	665	1181	217	193	599	1009	1000
2014												1000
2015												1000
2016												1000
2017												1000
2018												1000
2019												1000
2020												1000
2021												1000
2022												
2023												
2024												
2025												

Survival and Initial Population Estimates

Year	Annual Juvenile Survival Rates			Annual Adult Survival Rates		
	Model Est	Field Est	SE	Model Est	Field Est	SE
1993	0.50			0.98		
1994	0.50			0.98		
1995	0.50			0.98		
1996	0.50			0.98		
1997	0.50			0.98		
1998	0.50			0.98		
1999	0.50			0.98		
2000	0.50			0.98		
2001	0.50			0.98		
2002	0.50			0.98		
2003	0.50			0.98		
2004	0.50			0.98		
2005	0.50			0.98		
2006	0.50			0.98		
2007	0.50			0.98		
2008	0.50			0.98		
2009	0.50			0.98		
2010	0.50			0.98		
2011	0.50			0.98		
2012	0.50			0.98		
2013	0.50			0.98		
2014						
2015						
2016						
2017						
2018						
2019						
2020						
2021						
2022						
2023						
2024						
2025						

Parameters:	Optim cells
Juvenile Survival =	0.500
Adult Survival =	0.980
Initial Total Male Pop/10,000 =	0.007
Initial Female Pop/10,000 =	0.060

MODEL ASSUMPTIONS	
Sex Ratio (% Males) =	50%
Wounding Loss (total males) =	10%
Wounding Loss (females) =	10%
Wounding Loss (juveniles) =	10%
Total Bulls Adjustment Factor	75%

Classification Counts								Harvest						
Year	Juvenile/Female Ratio			Total Male/Female Ratio									Segment Harvest Rate (% of Prehunt Segment)	
	Derived Est	Field Est	Field SE	Derived Est	Field Est w/ bull adj	Field Est w/o bull adj	Field SE	Juv	Yrl males	2+ Males	Females	Total Harvest	Total Males	Females
1993		33.33	5.87	10.84	32.04	24.03	4.81	6	10	25	18	59	37.0	3.2
1994		51.90	7.06	12.03	37.13	27.85	4.75	4	5	30	10	49	33.7	1.7
1995		38.61	5.82	17.47	31.22	23.42	4.28	1	10	24	18	53	23.9	2.8
1996		28.14	4.65	17.90	30.34	22.75	4.09	2	13	37	20	72	30.2	3.0
1997		46.78	6.34	17.15	32.75	24.56	4.23	3	28	19	27	77	29.6	4.0
1998		71.98	6.04	21.07	36.18	27.14	3.19	4	4	37	28	73	22.1	3.9
1999		32.60	3.09	31.92	23.20	17.40	2.12	8	5	31	78	122	13.6	9.8
2000		45.00	5.03	31.29	29.79	22.34	3.26	29	0	70	81	180	24.7	10.6
2001		24.01	2.80	32.19	22.87	17.15	2.30	22	11	53	56	142	22.4	7.5
2002		34.25	3.25	31.31	16.86	12.64	1.81	20	4	45	47	116	19.0	6.6
2003		44.81	5.19	31.94	43.71	32.78	4.25	10	16	31	38	95	17.9	5.3
2004		38.63	4.40	32.64	22.14	16.61	2.64	9	6	55	45	115	21.3	6.1
2005		51.96	5.30	32.80	32.27	24.20	3.27	7	2	48	19	76	17.4	2.6
2006		37.33	4.86	36.87	67.59	50.69	5.93	12	2	57	77	148	18.0	9.6
2007		30.32	3.78	37.86	22.62	16.97	2.68	12	0	62	71	145	18.7	9.1
2008		34.87	4.91	35.60	49.23	36.92	5.09	4	0	74	66	144	23.3	8.8
2009		44.27	5.77	35.50	77.08	57.81	6.89	28	8	50	53	139	19.4	7.3
2010		39.76	5.79	36.70	57.03	42.77	6.07	18	11	63	94	186	23.8	12.7
2011		20.54	3.66	42.13	77.12	57.84	7.02	41	3	44	105	193	15.9	15.1
2012		37.75	5.05	36.87	37.91	28.43	4.23	3	4	63	47	117	24.4	7.7
2013		36.22	4.41	32.21	38.85	29.13	3.85	15	6	75	60	156	31.6	9.9
2014														
2015														
2016														
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2019														
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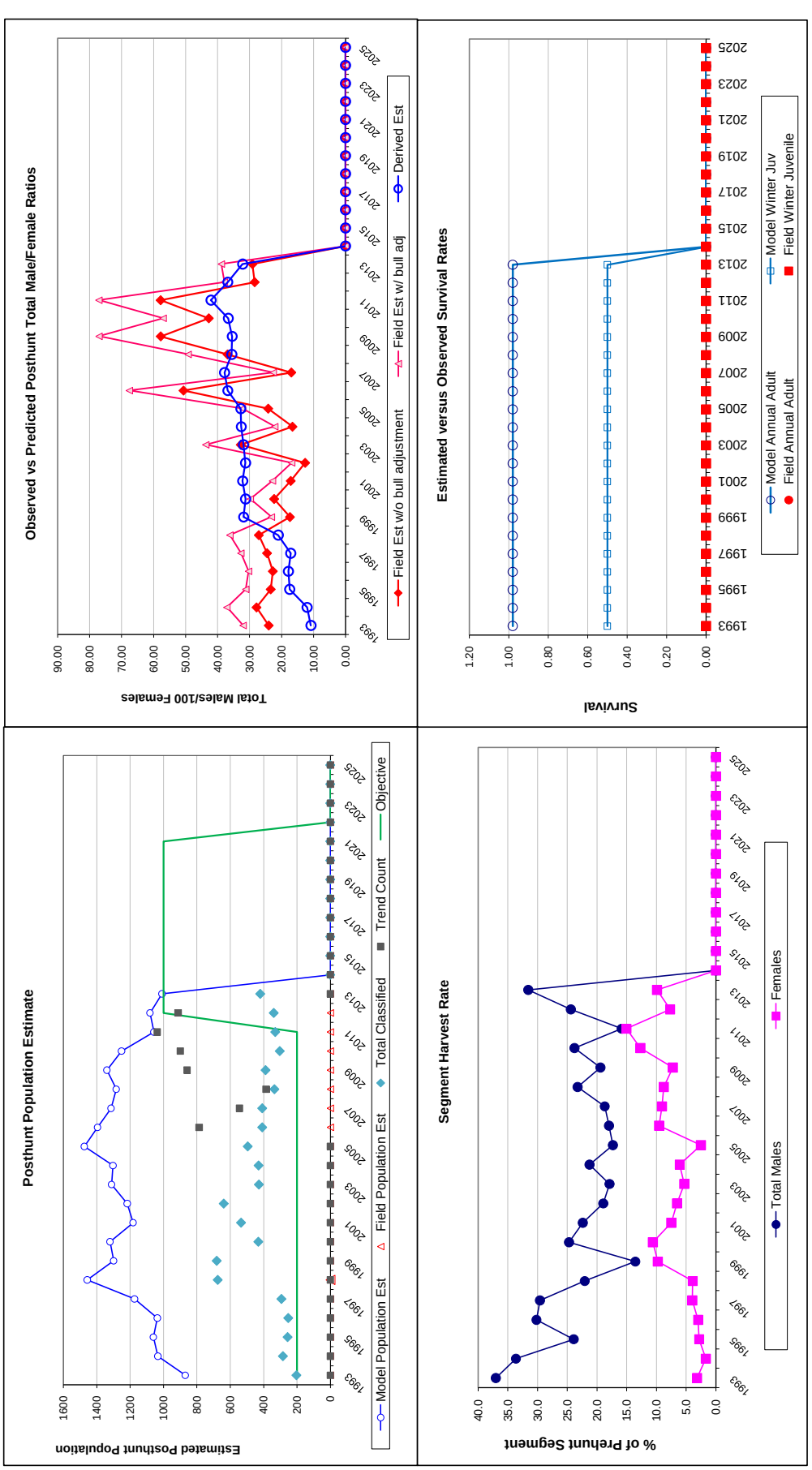
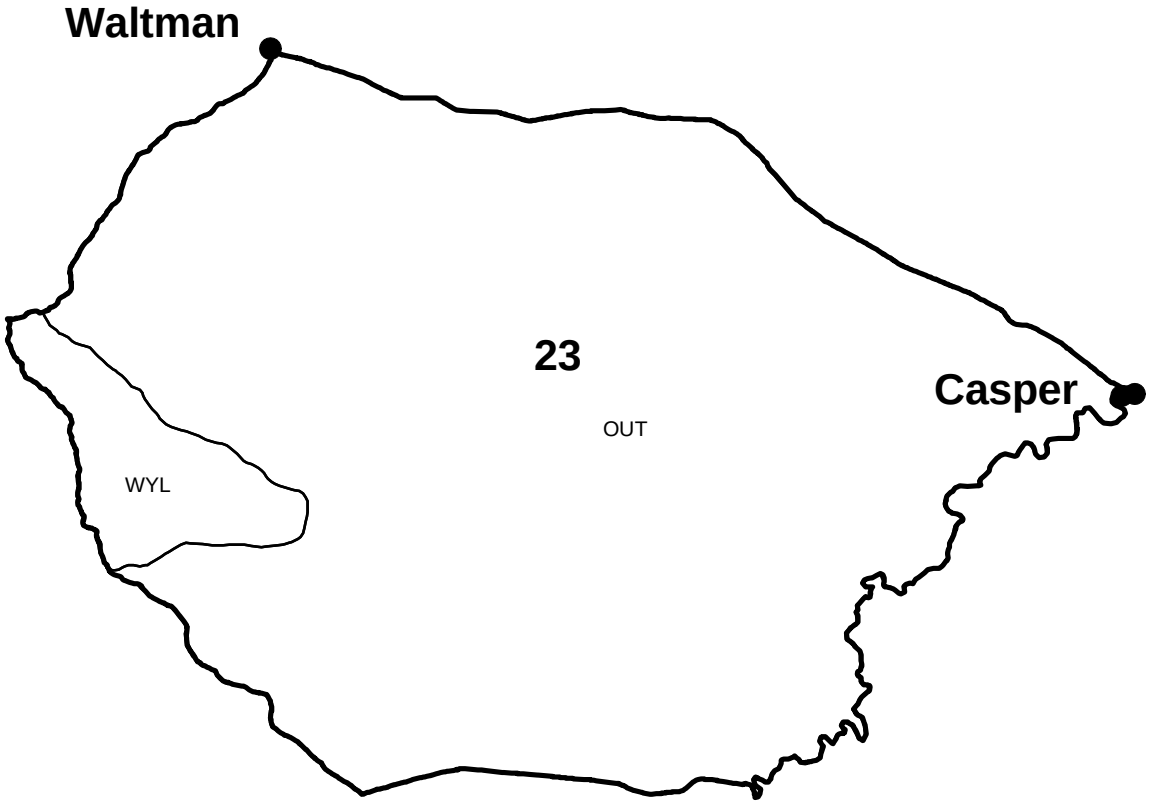
2021														
2022														
2023														
2024														
2025														

FIGURES



Comments:

Elk - Rattlesnake
Hunt Area 23
Casper Region
Revised 8/94

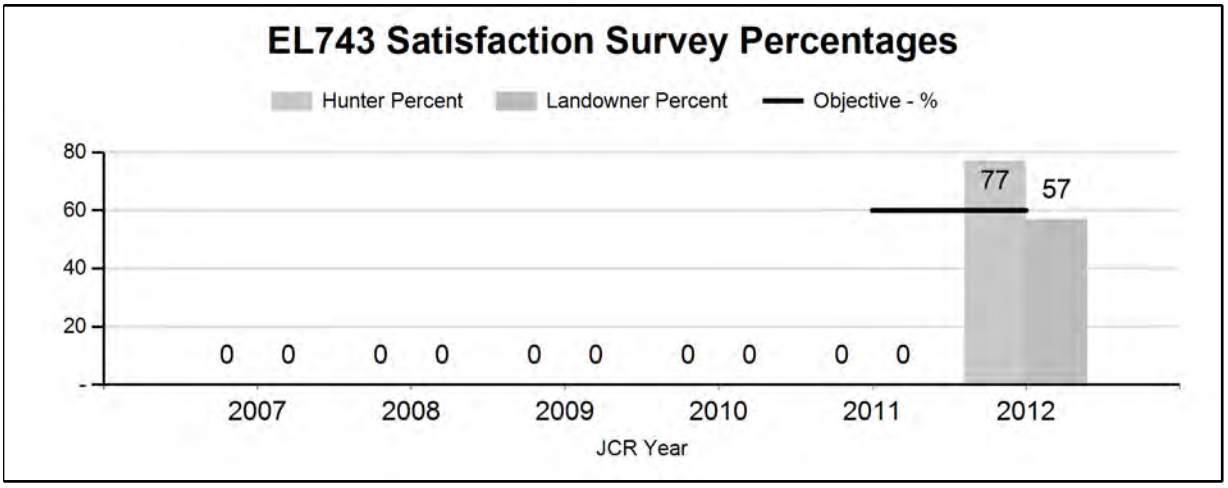


2012 - JCR Evaluation Form

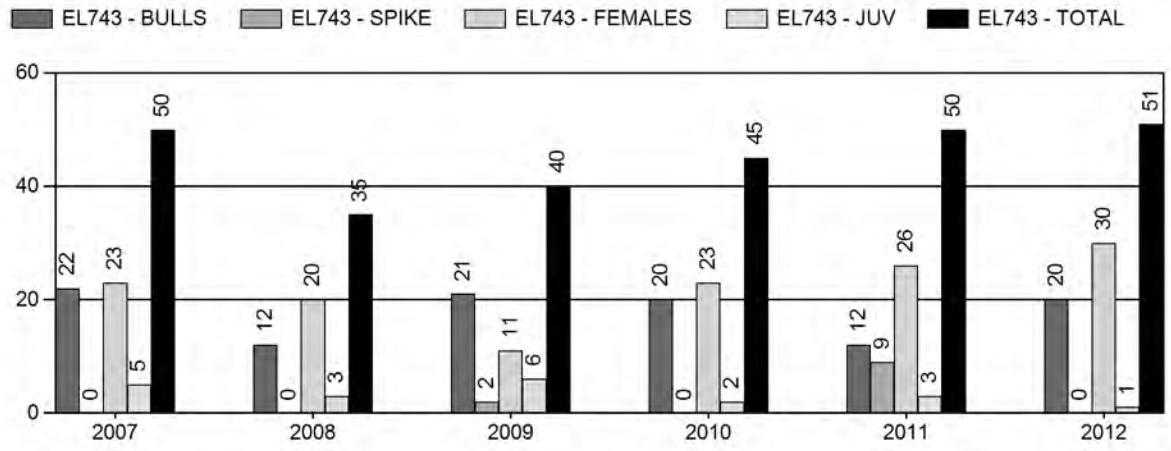
SPECIES: Elk
PERIOD: 6/1/2012 - 5/31/2013
HERD: EL743 - PINE RIDGE
HUNT AREAS: 122
PREPARED BY: HEATHER O'BRIEN

	2007 - 2011 Average	2012	2013 Proposed
Hunter Satisfaction Percent	0%	77%	80%
Landowner Satisfaction Percent	0%	57%	60%
Harvest:	44	51	75
Hunters:	66	71	110
Hunter Success:	67%	72%	68 %
Active Licenses:	69	67%	140
Active License Percentage:	64%	67%	54 %
Recreation Days:	323	352	550
Days Per Animal:	7.3	6.9	7.3
Males per 100 Females:	0	0	
Juveniles per 100 Females	0	0	

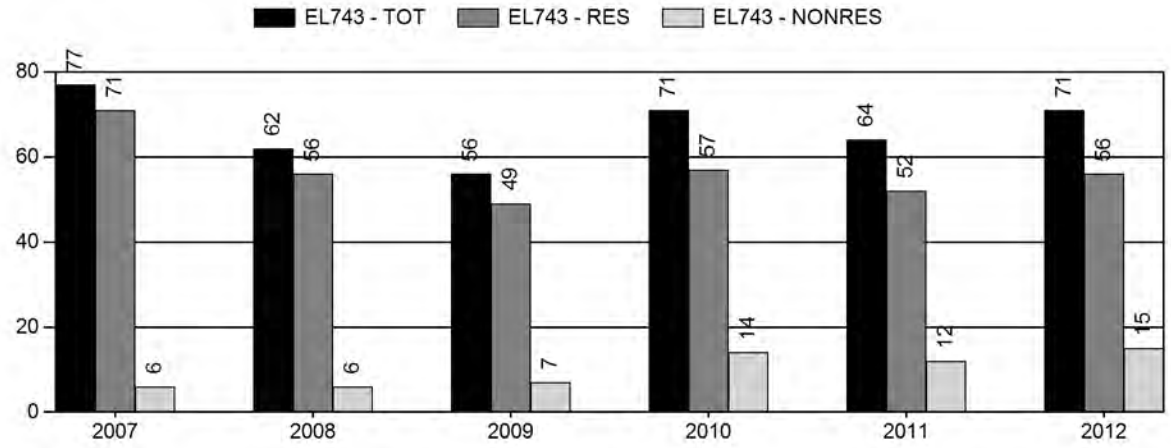
Satisifaction Based Objective	60%
Management Strategy:	Private
Percent population is above (+) or (-) objective:	7%
Number of years population has been + or - objective in recent trend:	1



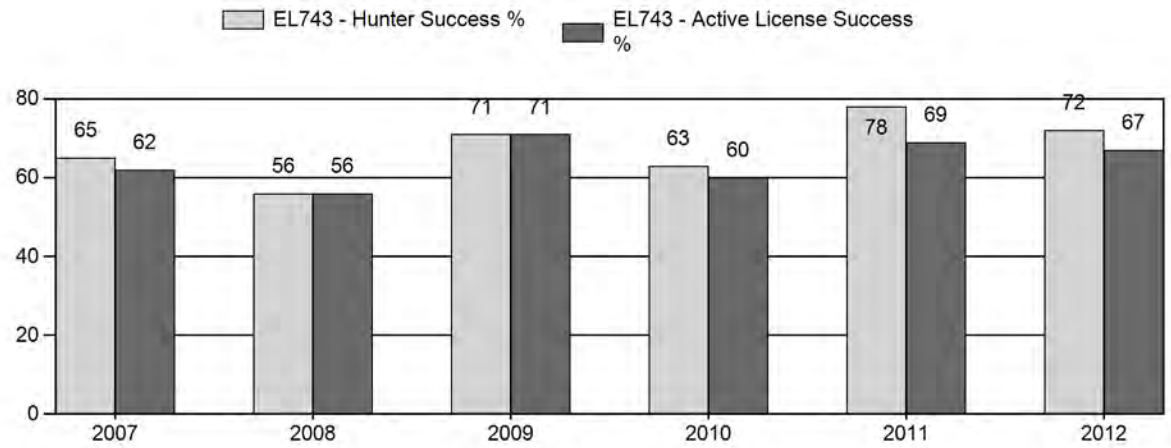
Harvest



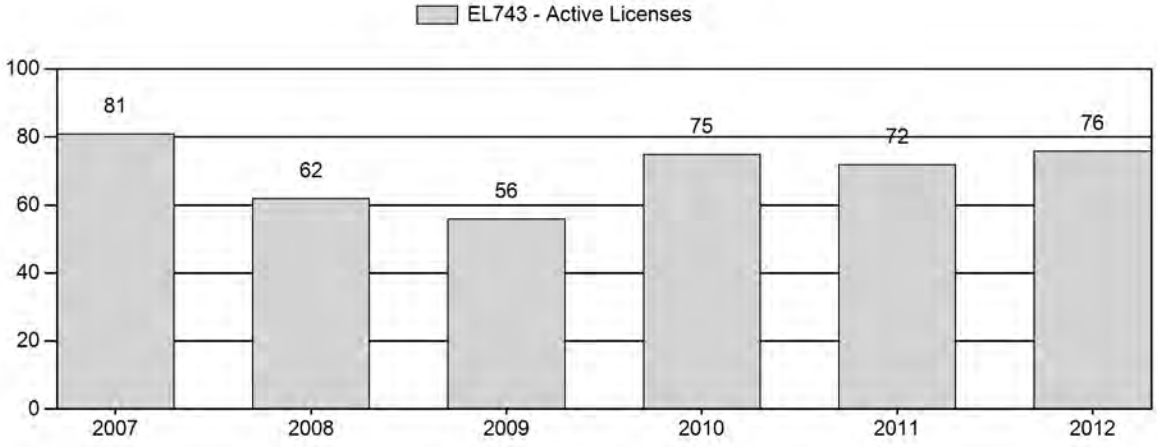
Number of Hunters



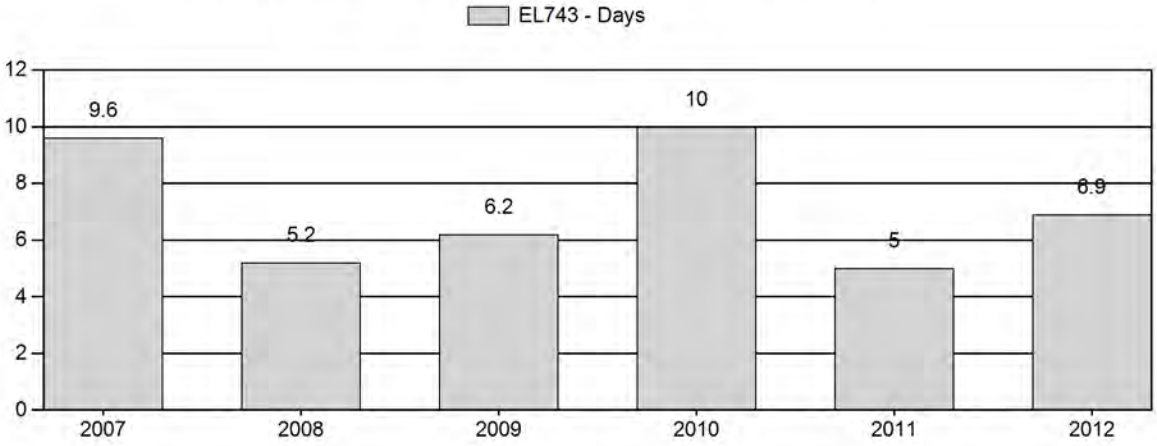
Harvest Success



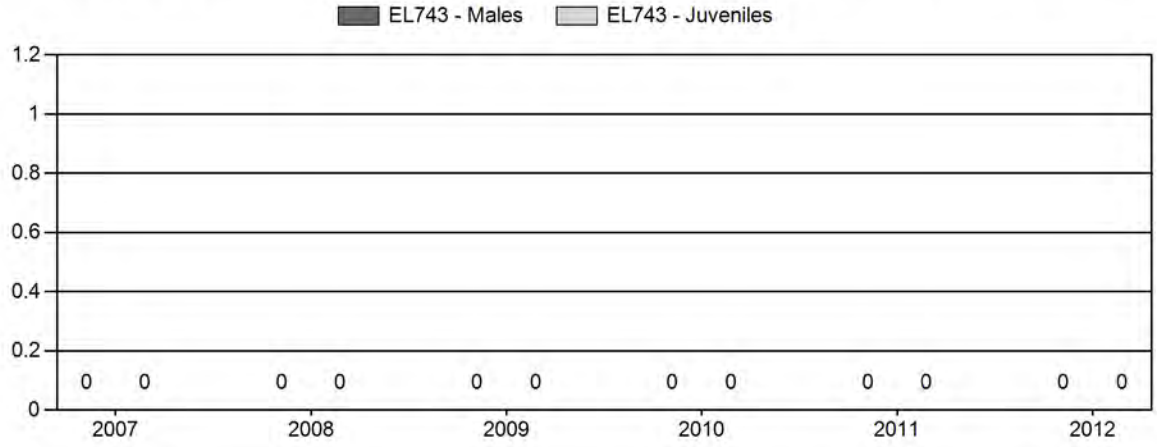
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2013 HUNTING SEASONS
PINE RIDGE ELK (EL743)

Hunt Area	Type	Date of Seasons Opens	Closes	Quota	Limitations
122	1	Oct. 15	Nov. 30	100	Limited quota licenses; any elk
		Dec. 1	Dec. 14		Unused Area 122 Type 1 licenses valid for antlerless elk
	6	Oct. 15	Dec. 14	100	Limited quota licenses; cow or calf
Archery		Sept. 1	Sept. 30		Refer to license and type limitations in Section 3

Hunt Area	Type	Quota change from 2012
122	1	+50
	6	0

Management Evaluation

Current Hunter/Landowner Satisfaction Management Objective: 60% hunter/landowner satisfaction; bull quality
Management Strategy: Private Land
2012 Hunter Satisfaction Estimate: 77%
2012 Landowner Satisfaction Estimate: 57%
Most Recent 3-year Running Average Hunter Satisfaction Estimate: NA
Most Recent 3-year Running Average Landowner Satisfaction Estimate: NA

The Pine Ridge Elk Herd Unit has a management objective based on 60% or higher landowner and hunter satisfaction. As a secondary objective, managers strive to maintain a bull harvest consisting of 60% mature, branch-antlered bulls. This objective was revised in 2012. An objective based upon postseason population estimates was not feasible for this herd unit.

Herd Unit Issues

Nearly all elk in this herd reside in and along the timbered Pine Ridge escarpment in the north central portion of the herd unit. Land use consists of traditional ranching and livestock grazing mixed with areas of intensive oil and gas, wind, and uranium development. Access to hunting is tightly controlled by private landowners, and achieving adequate harvest to manage growth of this herd is very difficult. Most landowners have historically voiced satisfaction with the number of elk on their lands within this herd, thus hunter access has remained restricted. Many

landowners that control access to elk in this herd charge high fees for bull hunting, and access for cow/calf hunting is limited such that two thirds of Type 6 licenses typically remain unsold annually.

Weather & Habitat

Currently there are no habitat or classification data collected in this herd unit given the Department's minimal management influence and budgetary constraints. Instead, fixed-wing winter trend counts are conducted as budget and weather conditions allow. Previous trend counts conducted in 2009 and 2010 found a total of approximately 350 and 150 elk, respectively. A winter trend count conducted under optimum conditions in December 2012 found a total of 840 elk, indicating this herd is larger than field personnel and landowners previously believed.

Field Data

Landowner and hunter satisfaction surveys are used to manage the Pine Ridge Elk Herd Unit. Survey results must show that 60% of landowners and hunters alike were either "satisfied" or "very satisfied" with the previous year's hunting season in order to justify similar seasons for the following year. A secondary objective is also used in the Pine Ridge Elk Herd Unit to anchor the results of satisfaction surveys to a population parameter. In this case, age class targets are determined from the harvest survey and used as a measure of bull quality. The percentage of mature (i.e. branch-antlered) bulls in the male portion of the annual harvest is used, with a 3-year trend average of 60% minimum being the threshold for management action. In 2013, 57% of landowners and 77% of hunters who returned surveys said they were "satisfied" or "very satisfied" with the number of elk in the Pine Ridge Elk Herd Unit, and the three-year average for mature bulls in the harvest was 86%. While hunter satisfaction and quality of harvested bulls exceeded the 60% threshold, landowner satisfaction did not. Managers are therefore tasked with making changes to the 2013 hunting season in an attempt to improve landowner satisfaction.

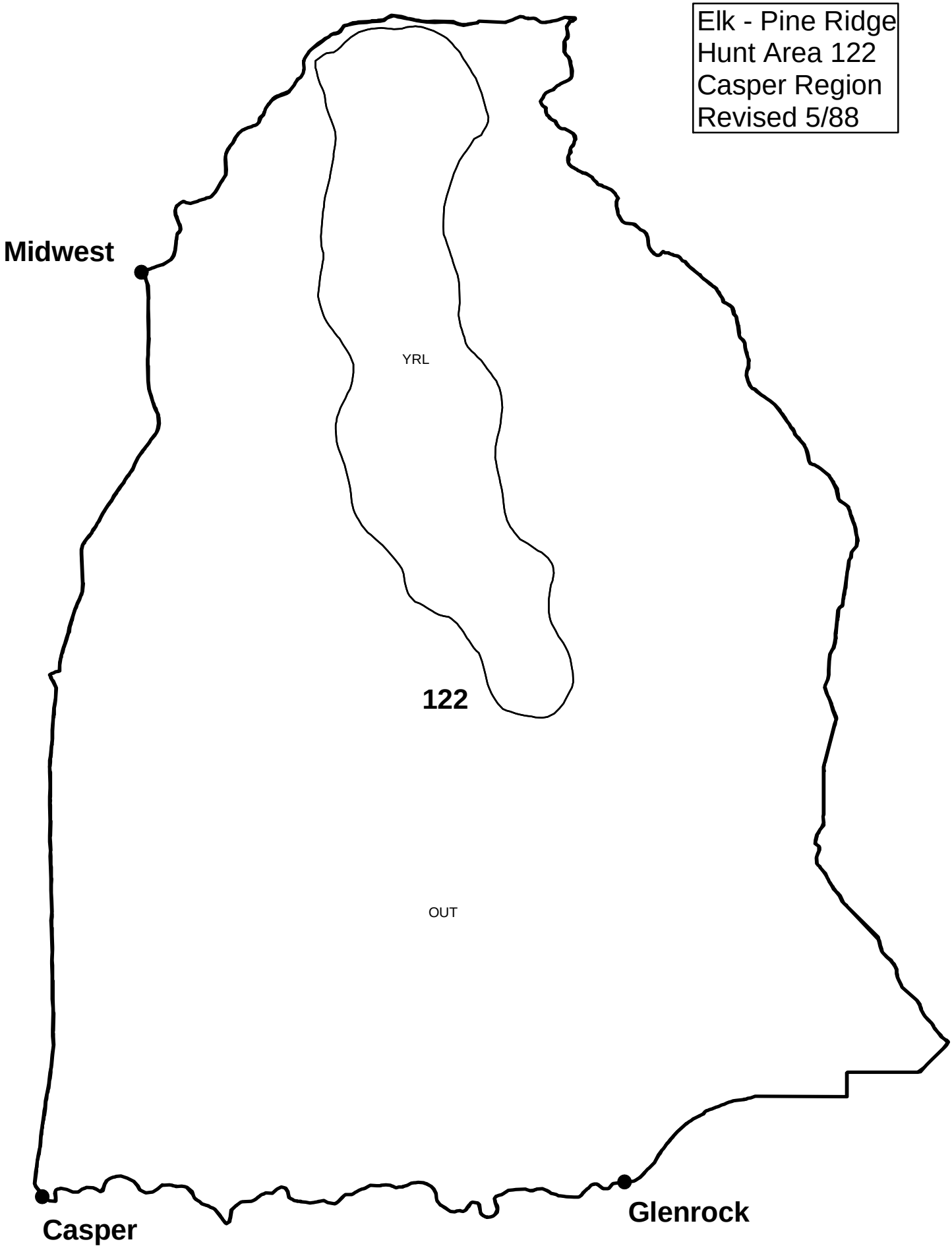
Harvest Data

Hunter success in this herd unit is typically in the 50-70th percentile and fluctuates with access and license issuance. Hunter success has improved the last three years in a row from 63 to 80 percent, while license issuance has remained constant and antlerless elk licenses have remained undersold. Improved harvest success is likely associated with a growing number of elk in the Pine Ridge Herd, though other factors may have contributed to hunter success such as improved weather conditions for access. Despite improved hunter success, leftover antlerless licenses indicate landowner tolerance of hunters remains low while tolerance of elk remains high. Until landowners agree to provide more liberal access to antlerless elk hunters, an increase in antlerless elk license issuance is not warranted. However, several landowners have requested

an increase of Type 1 any-elk licenses for 2013. Though higher harvest of bulls will not control the continued growth of this herd, Type 1 hunters can purchase an additional Type 6 license. Managers are hopeful that encouraging this possibility with hunters will increase both bull and cow harvest in the herd unit, and that landowners will grow accustomed to a higher number hunters on their ranches.

Management Summary

The elk season in this herd unit now opens on October 15th following the close of deer seasons. In more recent years, closing dates have been extended as landowners have agreed to liberalize access later in the season. The same season dates will be used for 2013, with an increase of Type 1 licenses as several landowners have expressed the desire for additional hunters. An increase of Type 6 licenses cannot be justified until access improves for antlerless hunters within the herd unit. Goals for 2013 are to increase communications with landowners to discuss options that will increase female elk harvest, to improve hunting access, and ultimately improve landowner satisfaction regarding elk numbers in this herd.


Elk - Pine Ridge
Hunt Area 122
Casper Region
Revised 5/88
Midwest
YRL
122
OUT
Casper
Glenrock